

ReNew

September/October 2021

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Top100
Canada's Biggest
Infrastructure Projects

View this year's Top100 Projects at top100projects.ca

For details regarding our annual celebration visit renewcanada.net/top100-projects



STRATEGIC INFRASTRUCTURE THINKING

By John Tenpenny

The results are in and with more than 300 organizations and individuals having submitted their views on the federal government's National Infrastructure Assessment there seems to be broad support for the three main priorities of the consultation: to assess Canada's infrastructure needs and establish a long-term vision; to improve coordination among infrastructure owners and funders; and to determine the best ways to fund and finance infrastructure.

The report, "Building Pathways to 2050: Moving Forward on the National Infrastructure Assessment," provides a clearer picture of how the government plans to take on these priorities, said Infrastructure Minister Catherine McKenna.

"We heard that the Assessment should offer a strategic approach to near, medium, and long-term investment decisions over the next 30 years and help us achieve a net-zero economy through coordination at all levels of government and continued collaboration with Indigenous communities, experts, stakeholders, industry, and Canadians more broadly."

One of the most critical recommendations is the call for an independent advisory body—with a clear mandate to carry out the assessment and provide the government with impartial expert and evidence-based advice.

In its submission, the Business Council suggested that infrastructure planning should be decoupled from politics, similar to approaches already adopted in countries such as Australia and the United Kingdom. For example, Infrastructure Australia conducts periodic audits of the country's nationally significant infrastructure. The agency develops 15-year rolling infrastructure plans and weighs the business case for each project based on its impact on productivity and economic growth. Infrastructure Australia's work is insulated from the political process, ensuring that infrastructure priorities

are determined using objective scientific and economic criteria.

This is an idea that we here at ReNew have been advocating for since our first editorial 16 years ago.

A recent report from the International Institute for Sustainable Development (IISD) found Canada's "infrastructure deficit" is anywhere from \$150 billion to \$1 trillion, with the gap for First Nations infrastructure between \$25 billion and \$30 billion. In other words, to meet the country's needs, much more financing will have to become available.

Public-private partnerships, or P3s, have long been one way to finance infrastructure projects and the Canada Infrastructure Bank (CIB) has a strategy "to grow the pie" by bringing in private investment.

At the time of McKenna's announcement, Tamara Vrooman, CIB's chair said the Bank had funded and financed about \$13.9 billion in projects, over 70 per cent of those in the last six months alone, with most of that financing coming from the private sector.

Finance and planning will also have to play a part moving forward as Canada's infrastructure also needs to be climate-resilient—both built and natural infrastructure will be needed to effectively adapt to climate change.

Greater incentives and professional support will be needed to integrate climate change considerations into infrastructure design, construction, and maintenance.

There also must be more awareness of the economic, social, ecological, and protective benefits of hybrid built and natural infrastructure solutions.

Working together, governments and business can improve collaboration among infrastructure owners and expand funding sources and financing instruments to build back better. 🌱

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ReNew Canada

Richmond, B.C.'s city hall was one of the first major civic buildings in the province to prominently feature a wood and heavy-timber structure as its defining architectural statement. The galleria structure (pictured) is a series of Douglas-fir glue-laminated timber portal frames with heavy-timber decking.

To read our article on mass timber's coming of age in Canadian construction, see page 16.

Cover Photo: © Martin Hesleick courtesy naturallywood.com

FEDERAL GOVERNMENT BLOCKS QUEBEC CITY PORT EXPANSION PROJECT



Credit: Port of Quebec

Plans to build and open an ultra-green, deep-water container terminal in Quebec City by 2025 are off.

The federal government has blocked the Laurentia Project, a major deep-water expansion at the Port of Quebec, having determined the potential significant direct and cumulative adverse environmental effects of the project are not justified in the circumstances.

The Impact Assessment Agency of Canada's Environmental Assessment Report concluded that the Laurentia Project: Port of Quebec Deep-Water Wharf – Beauport Sector was likely to cause significant adverse environmental effects to fish and fish habitat, air quality and human health, socio-economic conditions, and the current use of lands and resources for traditional purposes by Indigenous peoples.

According to the Environment Canada, since this decision applies to the Laurentia Project, it does not prevent the Quebec Port Authority from submitting new project proposals and does not preclude potential development.

"We are obviously very disappointed by this outcome," said Port of Québec president and CEO Mario Girard. "It's unfortunate that we weren't able to reconcile our experts' opinions with those of the experts. We remain convinced that there were workable solutions and that Laurentia was a fundamentally good project, both for the economy and for the environment." 🍁

NEXT ISSUE: NOVEMBER/DECEMBER CANADA'S NUCLEAR FUTURE

Laying it on the Line

The case for high-speed rail

Getting to Net Zero

Hybrid building construction

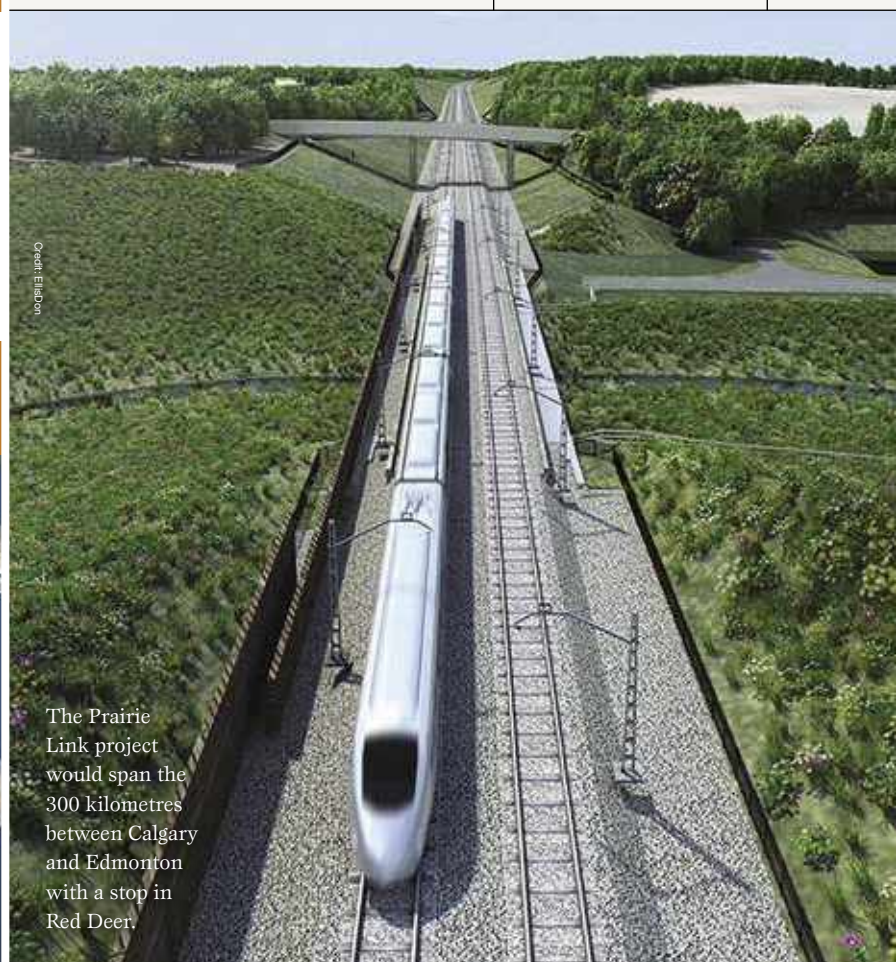
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The Prairie Link project would span the 300 kilometres between Calgary and Edmonton with a stop in Red Deer.

ALBERTA HIGH-SPEED RAIL IN DEVELOPMENT

EllisDon announced that they have formed a partnership with Aecom (Prairie Link) to advance the development of high-speed rail connecting Edmonton, Red Deer, and Calgary in Alberta, Canada. EllisDon and its team took the initiative to propose the project within the Government of Alberta's Unsolicited Proposal Guidelines and Framework.

"The notion of high-speed rail—a proven technology around the world—connecting Edmonton, Red Deer, and Calgary in Alberta is not new, but we believe that its time has come. We have built a team with both the capacity and faith in the future of our province to advance it in a meaningful way for Albertans," said Jeffrey Hansen-Carlson, director with EllisDon Capital and project director for Prairie Link.

Prairie Link has secured a Memorandum of Understanding (MOU) from Alberta Transportation laying the foundation for cooperatively advancing project development. With an estimated capital cost of \$9 billion, the project will be among the largest and most defining nation-building transportation projects in Alberta's history.

"Since this is a private sector initiative it is very important to us that we continue to maintain positive and solution-orientated day-to-day relationships with the great people that work for the Government of Alberta," said Joey Comeau, CEO and executive vice president of EllisDon Capital and chair of the board of Prairie Link. 🍁



NEW APPROACH FOR BUILDING RETROFITS

Credit: Energyspring International/Fabrice Sirey

A new report by Efficiency Canada, a policy advocacy and research organization at Carleton University, outlines how to spark innovative approaches to building retrofits.

There is no pathway to achieving Canada's greenhouse gas reduction commitments that does not include retrofitting Canada's millions of residential and commercial buildings.

Yet, at the current pace it will take 142 years to retrofit all low-rise residential buildings and 71 years to retrofit all commercial floor area. Current policies are

focused on short-term results, and markets are segmented and uncoordinated.

The missing sauce for a booming retrofit market is an innovation-oriented approach, guided by an ambitious mission, according to the report.

The report titled "Canada's Climate Retrofit Mission, outlines a policy framework focused on triggering economies of scale and innovations to reduce costs, increase speed and enhance value. It also recommends on-the-ground market development teams will coordinate the upgrading of several buildings at once and introduce new retrofit models.

The report envisions Canada undertaking a mass retrofit of all buildings within a generation to eliminate fossil fuels, while also freeing up enough clean electricity resources to power 10 million electric vehicles.

"To meet climate goals we need to see increases in scale and decreases in cost for building retrofits that are similar to what we have seen in wind, solar, and battery technologies. A mission-oriented approach focused on transforming the retrofit process to accomplish this," said report author Brendan Haley. 🍁



CANADA MUST CLIMATE-PROOF INFRASTRUCTURE INVESTMENTS

The climate crisis is here and its impacts, such as record-breaking high temperatures in Western Canada, are bringing new risks and challenges for the nation's infrastructure.

A new report from the International Institute for Sustainable Development (IISD), prepared with support from Infrastructure Canada, makes one thing clear: how we create and maintain our built environment must change.

"[Recent events] have shown us first-hand how climate change can damage the infrastructure in Canada, risking lives and costing billions in repairs," said Anne Hammill, senior director of IISD's Resilience Program. "We need our municipalities and governments to better incorporate climate

change risks into the design, operation, and rehabilitation of our built infrastructure, while also looking more seriously at the benefits of using nature-based solutions."

"Advancing the Climate Resilience of Canadian Infrastructure: A review of literature to inform the way forward," profiles the ways in which action is already being taken nationally and internationally through policies, tools, and financing to enable more resilient infrastructure. But greater effort and investments are needed to keep up with the accelerating pace of climate change.

The authors also look at the role of natural infrastructure (a nature-based solution), such as wetlands and living shorelines, in providing a cost-effective way to increase resilience while providing other benefits

such as carbon sequestration, species habitat, and recreational spaces.

Among the key messages and areas for action identified:

- One third of core public infrastructure is in poor condition.
- The estimated infrastructure deficit in Canada is between \$150 billion and \$1 trillion.
- Greater incentives and professional support are needed to integrate climate change considerations into infrastructure design, construction, and maintenance.
- There must be greater awareness of the economic, social, ecological, and protective benefits of hybrid built and natural infrastructure solutions. 🍁



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Credit: Water Movement

THE WATER WHISPERER

Warren Brown is an advocate for Indigenous water infrastructure.

By Evan Pilkington

“**W**arren’s dedication to operator advocacy is recognized not only by his community of Lytton First Nation, but also fellow colleagues in the water industry.”

That’s what Candace Cook, research engineer at RESEAU CMI, had to say when she nominated Warren Brown for the Water Canada magazine’s Water’s Next Awards. The Selection Committee also echoed Cook’s sentiments, which is why Brown was awarded both the Water/Wastewater Operator and the Water Steward of the Year award at this year’s celebration.

As the operations manager for the community of Lytton First Nation, Brown is directly responsible for providing safe drinking water/wastewater services. He is also responsible for road maintenance for 13 drinking water systems.

While he juggles many tasks in delivering these services, they make up one part of the work he does on a day-to-day basis. Brown is an advocate for Indigenous water operators in Canada. His commitment to raising

awareness of issues faced by water operators has reached international news outlets, including the BBC.

In addition to regular requests for Brown to join committees and the numerous invitations to work with neighboring Indigenous communities, his insight and expertise is sought by many high-profile

should learn about their systems.

“I would tell my fellow operator about how I would enter a plant and take a moment to listen before doing anything. This will help them understand that when the system has an issue, they will know right away because it will sound different when he enters. I would also tell them that once they get

Warren’s dedication to operator advocacy is recognized not only by his community of Lytton First Nation, but also fellow colleagues in the water industry.

academic institutions. Most recently, Brown was asked to be the host for a series of water operations training videos. These videos, in turn, have been distributed to Indigenous operators across Canada.

Brown has been called the “Water Whisperer” because he’s often approached and asked to explain how water operators

comfortable with the systems, they should learn everything about them, so that even if they’re not on site, they can walk anyone through a system over the phone to help correct an issue.”

Beyond his day-to-day work, Brown never hesitates to assist community members with home repairs and maintenance. He often

carves out time each day to give educational tours of his facilities to students and interested residents. Going even further, Brown recently developed a summer program to foster practical maintenance skills for youth participants.

"This job is not about money," comments Brown when reflecting on his busy work life. "I know I'm underpaid and will never be a millionaire. At some point, we realize our importance, and we do this work for our family and community. I can sleep knowing I did the best I can, for them."

Brown works to inspire the next generation of water leaders and operators through dedicated outreach efforts. As an educator and mentor, his driving goal is to help others gain the understanding and skills needed to thoughtfully improve Indigenous water outcomes and become allies in advocacy.

"I believe the best way to educate the public on the importance of water, is through the youth," says Brown. "Have the youth ask their parents the hard questions as to why they feel they need to water a lawn all day, or why they need to refill large pools with fresh water instead of installing a filter system?"

Brown says he hopes to continue building relationships with post-secondary institutions and engineering students to work toward finding better ways to make potable water.

"And answering questions from those who want to know more about water operations and water quality. I also hope to meet and make more friends in the industry."

His efforts have not gone unrecognized. With industry peers and coworkers appreciating Brown's growing influence in the greater water industry, his colleague, Cook reflects that "the exemplary vision and leadership demonstrated by Brown has laid the foundation for operators to ensure that systematic problems and water inequities become a thing of the past in Indigenous communities."

In speaking to Brown, one will quickly come to understand that his passion rests in working for his people. His stories do not touch on his own successes, but rather are filled with the pride he feels when those around him reach their potential. 🌱



Evan Pilkington is a seriously water-obsessed freelance writer.



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Credit: RESEAU-WaterNET

Warren Brown participated in an exercise that demonstrates the “circle of trust” that ended Lytton First Nation’s Nickeyeah drinking water advisory several years ago.

Credit: RESEAU-WaterNET

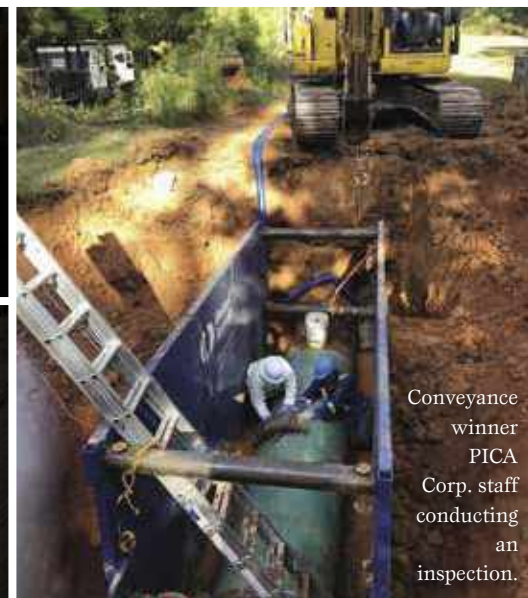
Candace Cook, research engineer at RESEAU CMI nominated Warren Brown because of his advocacy for his community and his fellow colleagues in the water industry.



LuminUltra was selected as the Company of the Year for its solution that aims to help keep our communities safe from viral threats.



The Co-operative Stormwater Management Initiative (CSMI) was selected as the winner in the Stormwater category.



Conveyance winner PICA Corp. staff conducting an inspection.

Credit: PICA Corp.

Credit: Mark Ferguson



Jay Famiglietti, host of the Let's Talk About Water (LTAW) podcast won in the Education and Outreach category.

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2021 WATER'S NEXT AWARD WINNERS

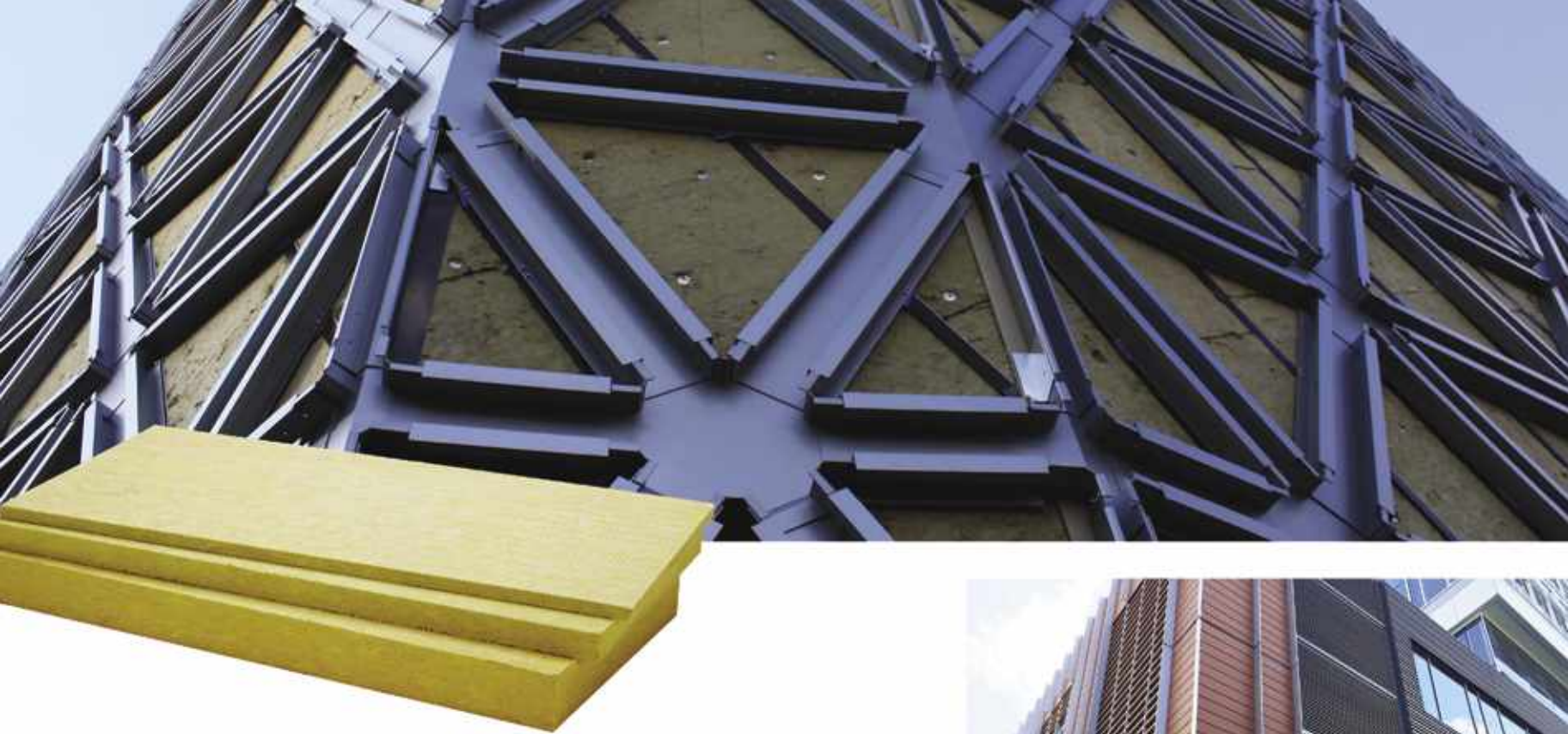
Water Canada's magazine Water's Next Awards program is the only national awards program that honours leadership across the entire water sector—including public servants, young professionals, researchers, and technology providers. Since 2010, Water Canada has hosted the awards to

help strengthen and celebrate this national community of water leaders, champions, and innovators.

“We received many impressive nominations this year,” said Simran Chattha, chair of the 2021 Water's Next Awards. “Congratulations to all of the winners! They have all shown a strong commitment

to improving and building upon the work that has been done in the Canadian water industry.”

Water Canada received 70 submissions for the 2021 Water's Next Awards. As part of the judging process, the Selection Committee identified 38 finalists and 15 award winners. 🍁



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INDIGENOUS MEGAPROJECTS

Canada's First Nations communities are forging new partnerships to build infrastructure. *By John Tenpenny*

Many of Canada's Indigenous communities are in need of new infrastructure, from water assets and better roads to stronger schools and clean energy.

New partnerships between First Nations communities and asset developers are leading to some of Canada's most incredible assets, assets that can be maintained by the communities they serve. This ability for the community to work on infrastructure assets, both in the short-term and long-term, is key for economic development.

How do we use these recent successes to encourage more asset development in remote communities? And how do we ensure capital is available for these projects to move forward in a timely fashion?

During a recent INFRAIntelligence webinar, with support from Sanexen, ReNew Canada explored Indigenous megaprojects and the infrastructure gap facing First Nations, Inuit, and Métis communities. Panelists discussed some of the initiatives being spearheaded by governments and First Nations to strengthen economies in Indigenous communities.

Major projects coalition

According to Sharleen Gale, chief of B.C.'s Fort Nelson First Nation, being involved in major infrastructure projects is increasingly important to Indigenous communities.

"Overall, there is a want from our Nations to become involved as partners in the economic activity that is happening in their territories and our participation in major infrastructure projects is an opportunity for us to help shape the future and strengthen our economies."

Stephen Lidington, with Colliers Project Leaders' infrastructure advisory practice, agrees.

"Meaningful equity stakes for First Nations in projects enables First Nations participation in the economic mainstream and develops future opportunities."

As chair of the First Nations Major Project Coalition (FNMPC), Gale has had a front row seat as the organization has advanced Indigenous communities' shared interest in gaining ownership of the major projects taking place in its territories, including in her own backyard.

"Our nation is championing the Clarke Lake Geothermal Project, which represents a \$100

million investment in the clean energy future of our territory," says Gale of the project that is scheduled to come online in 2024.

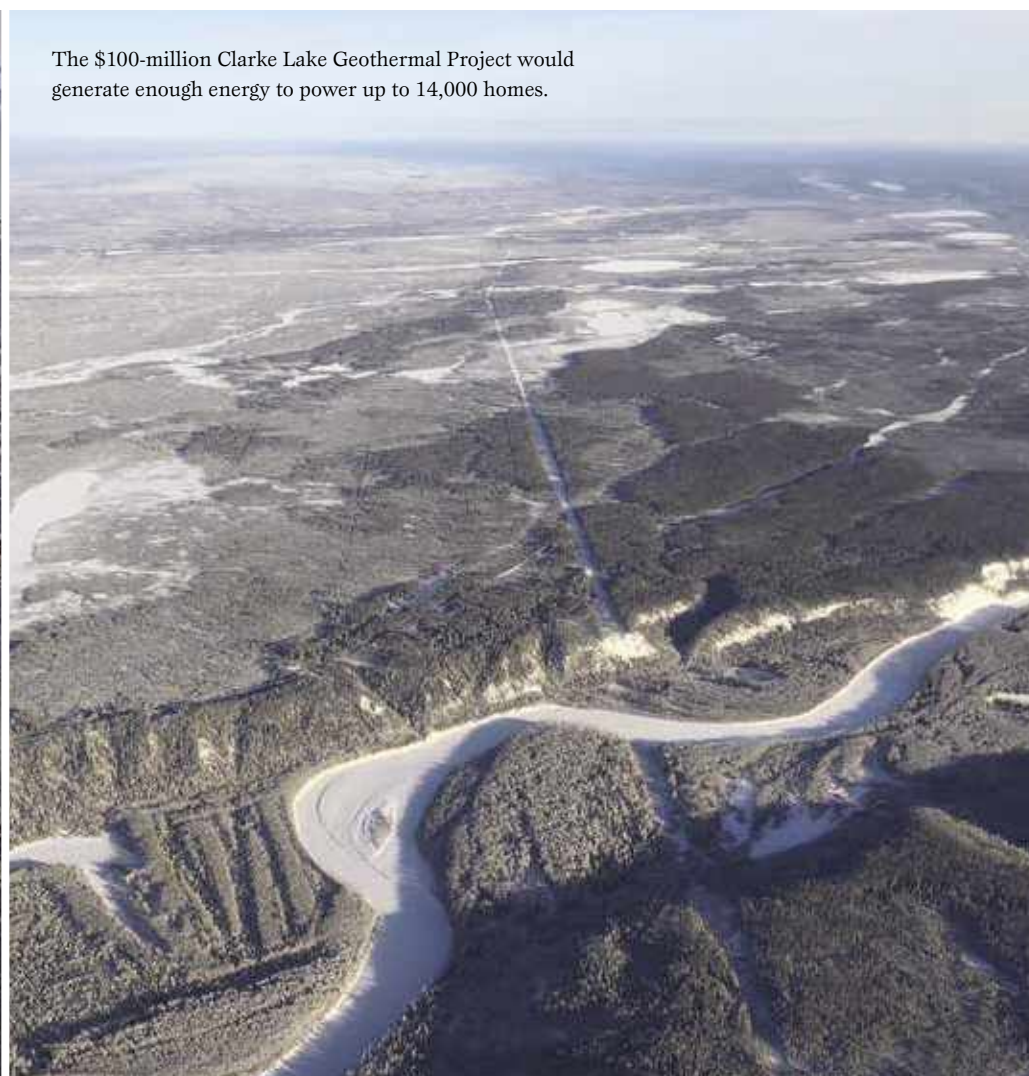
Being developed in the existing Clarke Lake gas field in British Columbia, the Clarke Lake project will use the mid-grade geothermal heat resources in its reservoir to reduce emissions by displacing fossil fuels, while also demonstrating the value of geothermal energy as a viable clean energy technology for rural, Indigenous, and northern communities.

The FNMPC currently has five projects in various stages of planning and development in its portfolio with a potential investment value of \$7 billion, including a group of 12 communities in Northern B.C. that have made the decision to acquire equity in the Coastal GasLink Pipeline. Gale adds that there is also interest from other Indigenous communities in participating in the Trans Mountain Pipeline project.

"What we're seeing is that the business readiness of our First Nations is increasing and we're moving beyond the traditional agreements to ownership and co-development."



The Keeyask Generation Project is a partnership between Manitoba Hydro and four partner First Nations.



The \$100-million Clarke Lake Geothermal Project would generate enough energy to power up to 14,000 homes.

Credit: B.C. Ministry of Energy, Mines and Low Carbon Innovation

Priority lending

Lending a hand is the Canada Infrastructure Bank (CIB), which recently announced the launch of the Indigenous Community Infrastructure Initiative (ICII), which will enable the building of new infrastructure projects in Indigenous communities.

As part of the ICII, the CIB will tailor its low-interest and long-term financing to provide loans of \$5 million and up, for up to 80 per cent of total project capital cost.

and help build and grow their community-based infrastructure.”

The program was developed with input from Indigenous leaders, communities, and infrastructure organizations, says Thatcher.

“Projects are being driven by communities that are growing in their financial and development capacity and understanding of how to forge strong partnerships and are looking for strong private sector partners to help see these projects through to fruition.”

“Access to competitively-priced equity capital is a major challenge.”

Becoming a partner is time consuming and capital intensive, says Lidington.

“It requires a tremendous amount of effort to be a credible and bona fide counterparty in these megaprojects, which is not inexpensive due to the amount of commercial, financial, and legal due diligence.

“And not many Indigenous communities have the capital to cover those development costs.”

Lidington and Gale both point to the important role the FNMPC plays in helping Indigenous communities navigate the capital markets and become partners in major projects.

But there is still much to be done.

“In one case when we sourced commercial capital for a project, we were told that it would be between 12 and 15 per cent when the rate of return of the project was going to be nine per cent,” explains Gale. “So, in that case, our member had to give up their equity interest in the project because they couldn’t find alternatives.”

First Nations have been advocating to the federal government to step in and help communities get across the

**We see these projects happening around us
and we want to be part of them.**

According to Hilary Thatcher, CIB’s senior director, project development for Indigenous infrastructure, the CIB was set up to attract and co-invest with private sector and institutional investors in five key priority areas—green infrastructure, clean power, broadband, public transit, trade and transportation.

“And these are all areas where many First Nations are seeking investments, either in large-scale projects where they can be a meaningful partner or in projects that are going to directly impact their communities

Others who are active in projects focused on infrastructure in the five key priority areas involving CIB Indigenous partners include the Oneida Energy Storage project in Ontario and the Kivalliq Hydro-Fibre Link, which involves the construction of a new 1,200-kilometre, 150-megawatt transmission line between Nunavut and Manitoba.

Barriers to progress

Most Indigenous communities have limited capital, says Gale, which means down payments on projects must be financed.



The Wataynikaneyap Power Transmission Project will connect 17 remote First Nations communities to the Ontario power grid.



finish line with access to capital, she adds. “We need that, either through loan guarantees or equity loan guarantees.”

To be clear says Gale, First Nations are not looking for handouts; rather, they are looking for help on commercial terms that enable them to enter into the economic mainstream in a big way.

“We see these projects happening around us and we want to be part of them,” she says.

At the recent First Nations Major Projects Coalition Indigenous Sustainable Investment Conference, FNMPC executive director Niilo Edwards called for a national strategy for Indigenous access to capital.

“For a lot of First Nations there isn’t a lot of risk capital around to stimulate a good return from money borrowed in the commercial markets, without some kind of credit enhancement or financing innovation from government. In Ontario, in Alberta, you have loan guarantee programs at the provincial level, which have proven successful. A national strategy is something

While recognizing that the need for funding is tremendous and that the federal government announcement will benefit First Nations communities, Gale believes that the work the FNMPC is engaged in is just as important.

“It’s a huge step in the right direction, but the coalition is focusing on ensuring our members get involved in equity positions and ownership and co-development of major projects.

“We know that the government isn’t always going to be there to help us with our funding needs and so we feel that the only way to be involved is to be part of these major projects as owners so we can bring our own revenue streams and use those funds to build the type of projects that raise the standards of living for our community members.”

Early engagement

Putting the communities in the forefront, and taking into account what is important

Early engagement with First Nations is critical, agrees Gale.

“We’ve had people come to us with preconceived plans and we’ve had to tell them that the project can’t be built where they wanted it.

“Had they come to us earlier and invited us to be part of the project, whether we wanted to be an equity partner or just wanted to ensure that the project they were building was going to be in line with our values, then we could have helped either way.”

Taking a community’s needs into account is the basis of a development plan known as La Grande Alliance—a \$4.7 billion dollar infrastructure agreement signed in February 2020 between the Cree Nation government and the province of Quebec.

It proposes road extensions and upgrades, a 700-kilometre railway to the far northern reaches of Cree territory, a deep seaport, new power lines and the creation of a network of protected areas, among other infrastructure projects to be built in three stages over the next 30 years.

Earlier this year, a \$4.4 million contract was awarded for the phase one feasibility study that also marked the start of a 12-month process aimed at involving stakeholders in the co-design of the plan that could transform Cree territory.

Continued efforts are required to work directly with First Nations in meaningful and collaborative ways that will lead to much-needed investments in better infrastructure and sustainable economic growth.

“It’s important that Canadians understand that we want our communities to look like communities,” says Gale. “We want beautiful homes, we want roads, we want fresh drinking water. These are all things that some of us have and some of us desire and we all have to work together so that we’re raising the living standards for our people.” 🍁

It requires a tremendous amount of effort to be a credible and bona fide counterparty in these megaprojects.

that needs to be paid close attention to by the federal government if we’re going to have true inclusion of Indigenous people in the economy.”

Budget benefits

In its Budget 2021, the federal government announced funding to help close infrastructure gaps in Indigenous communities. As part of an \$18 billion package, the government promised \$6 billion over five years to support infrastructure, including support for immediate demands, as prioritized by Indigenous partners, with shovel-ready infrastructure projects.

to them, even before a project is conceived, is important. As is having a clear idea of what the priorities and benefits are for the affected Indigenous community at the end of the project.

“What I’m hearing from Indigenous communities, and in my experience with those communities, is they want to be engaged in discussions of projects from the early development stage,” says Thatcher.

“No one knows the land better and it can save the project not only delays and costs but can save the project in terms of its reputation and its stake with a potential future Indigenous partner.”

John Tenpenny is the editor of ReNew Canada.



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A 14-storey academic building made of wood is to be built on top of the Goldring Centre on the University of Toronto's downtown campus.



Credit: Courtesy of MMA and Pakau Architects

SHAPING THE FUTURE

Mass timber projects are becoming a part of the everyday development landscape. *By John Tenpenny*

With changes to the building code now allowing for taller wood structures there is an opportunity for mass timber projects to become a part of the everyday development landscape.

Like any other emerging trend, there are barriers to success. Being able to scale up production, making appropriate changes to current policy, and the need to train an industry on building with a new material are challenges that must be overcome if mass timber is going to become a part of the everyday conversation for building procurement across Canada.

During a recent INFRAIntelligence webinar, with support from PCL Construction, ReNew Canada sat down with

mass timber industry leaders from across the country to discuss opportunities and challenges for future asset development. Panelists discussed how Canada's forestry sector is responding to this opportunity with innovation, products, and design.

State of timber

Natural Resources Canada recently released the State of Mass Timber in Canada (SMTIC) report, which noted: "Demand for more sustainable construction materials and methods as well as more sophisticated design and production systems is stimulating the construction market in Canada. Mass timber will shape the future of low-carbon construction and

development of the bioeconomy."

The growth in mass timber construction across Canada can be linked to progressive building codes, new mass timber products, innovative building systems, a growing number of designers and builders with expertise, increasingly affordable products and systems, interest in green building materials, and sustainable designs.

"We really are going mainstream," says Andrew Bowerbank, vice president of market development at the Canadian Wood Council. "[Mass timber is] following the trends that green buildings did 10 to 15 years ago."

It's also about acceptance, says Vivian Mansac, principal architect at Edmonton-based Reimagine. "There used to be a lot of resistance,



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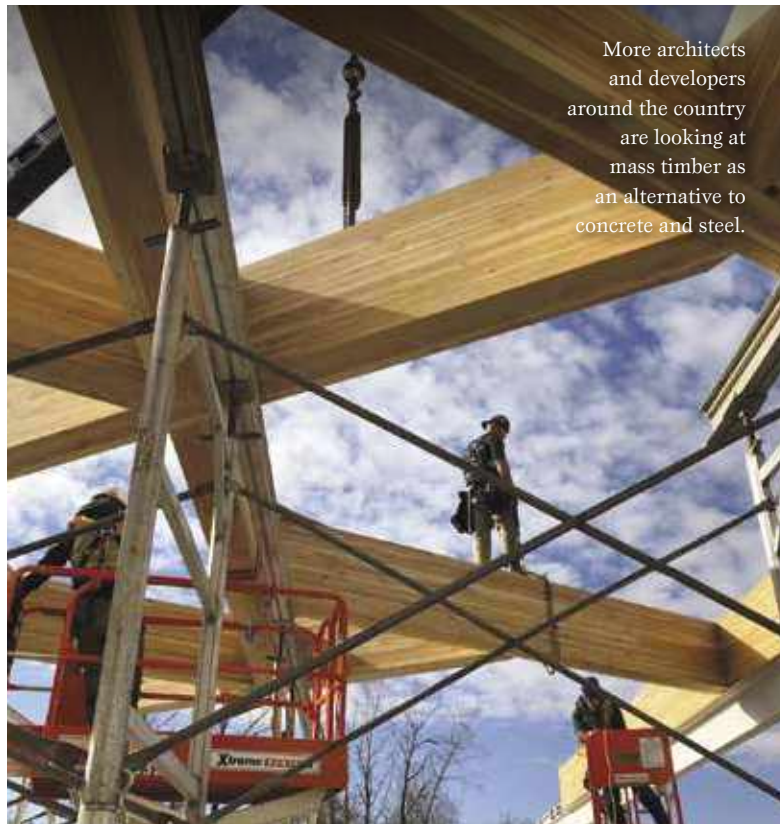
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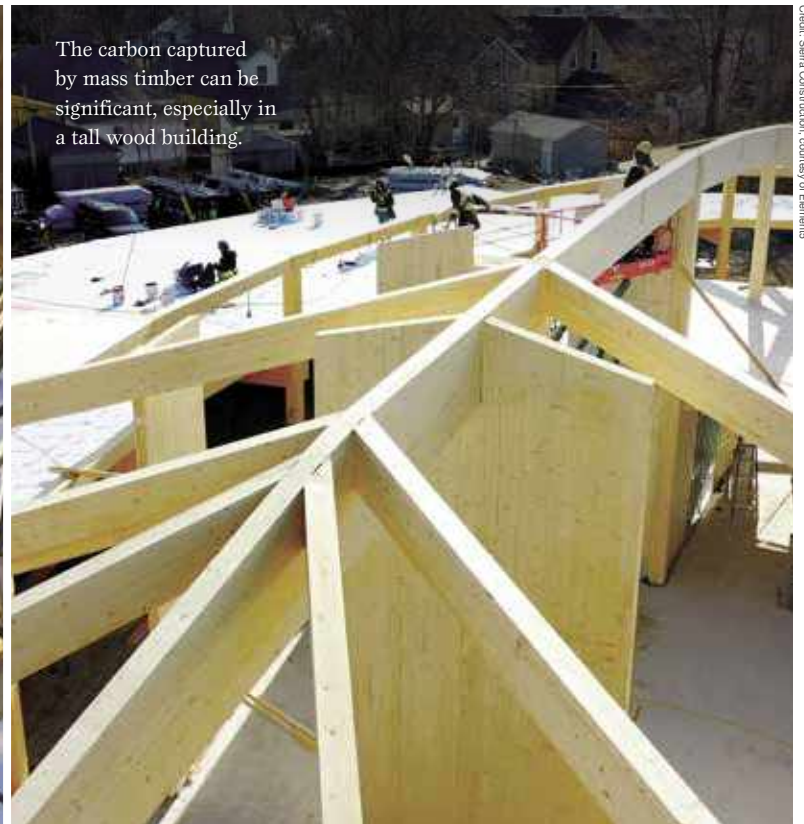
For more information, contact thecarpentersunion.ca or masstimbertoday.com.

Credit: Western Arctic



More architects and developers around the country are looking at mass timber as an alternative to concrete and steel.

Credit: Sierra Construction, courtesy of Element5



The carbon captured by mass timber can be significant, especially in a tall wood building.

partly within the engineering community, partly within the construction community, and partly within the owner community.

“What happens in the world of design and construction is that people look to precedents. Once there are 10 buildings they can look at, it’s easy to do the next 100.”

Patrick Chouinard, founder and director of business development with Toronto-based Element5, which specializes in the design, fabrication, and assembly of modern timber buildings, has seen a lot of uptake over the past two years. Element5 has two manufacturing plants producing CLT and glulam, in St. Thomas, Ontario and Ripon, Quebec.

generating a higher return on investment.”

The use of prefabricated mass timber components for both the structure and building envelope significantly reduce the construction schedule. This modular delivery method, where building components are factory-built and then rapidly assembled on site, offers cost savings over a strictly site-built project.

“For the owner/developer it’s a lower overall cost, but a higher selling price or rental income, because buyers and renters are willing to pay a premium to be in these wonderful spaces.”

Why? Biophilic design, says Bowerbank,

which is investing in eight mass timber buildings and four research projects. It also declared that every new civic building will be made mostly of mass timber, starting with Vancouver’s new St. Paul’s Hospital and the new Royal BC Museum in Victoria.

The \$4.2-million investment in mass timber demonstration projects and research will help urban planners and developers adopt mass timber building systems by supporting the incremental or first-time costs of design development, research, permitting, and construction activities.

The demonstration projects reflect a range of different building types and approaches to using mass timber that will highlight the versatility and performance of this building material. These include a firehall with strict post-disaster requirements, an Indigenous health and culture centre, and low-cost housing on Vancouver’s Downtown East side.

The research projects will study mass timber’s fire performance, the costs relative to steel and concrete, and carbon benefits. All project innovations and best practices will be broadly shared to promote learning and further advance mass timber use provincewide.

“B.C. is well positioned to be the world leader in sustainable design and construction innovations that can transform our economy and positively support our environment and climate footprint,” said Michael Green, architect and a member of B.C.’s mass timber advisory council, at the announcement of the program.

The world is desperate for solutions to climate change and the concrete and steel

Demand for more sustainable construction materials and methods as well more sophisticated design and production systems is stimulating the construction market in Canada.

“We’re inundated with new project opportunities on a weekly basis,” he says. “We’re seeing a lot more architects and engineers who have experience in mass timber design and engineering.”

According to Chouinard, it’s changing the way projects come to market. Traditionally, manufacturers and suppliers like Element5 targeted architects and engineers because they owned the customer relationship.

Now their primary target is owners and developers. “We’ve seen a huge uptake in interest from owners and developers because what offsite manufacturing and wood offers them is the prospect of

which is increasingly used to boost occupant well-being through connection to nature and the use of natural elements like daylight, plants, water, and exposed wood.

“People love to be near nature and natural products.”

Demonstrating versatility

With more architects and developers around the country looking at mass timber as an alternative to concrete and steel, governments like British Columbia’s are making it a priority, seeing it as an economic driver.

The province recently announced a new Mass Timber Demonstration Program,

THE WOOD INNOVATION
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MASS INNOVATION

We asked recent INFRAIntelligence webinar attendees some questions about the use of mass timber in construction.

Here's what they had to say:

What is mass timber's most appealing benefit?

Sustainability 87.5%

Strength 8.3%

Cost-effective 4.2%

What is mass timber's greatest obstacle?

Supply chain gaps 31.8%

Building code compliance 50.0%

Cost 18.2%

industries are responsible for somewhere between 12 and 14 per cent of the carbon dioxide in the atmosphere today. We know we can't continue to build the way we've been building the last 100 years, particularly as the population is expected to increase.

Carbon copy

Embodied carbon—the carbon dioxide (CO₂) emissions associated with materials and the construction process throughout the lifecycle of

Though mass timber offers many benefits over traditional building materials, its renewable nature and negative carbon impact are perhaps the most exciting. Turning trees into timber emits fewer greenhouse gases than the manufacture of traditional building materials like steel and concrete. That alone is a carbon benefit. However, it's the CO₂ that is removed from the atmosphere and stored in the wood—the sequestered carbon—that is the real game-changer.

“When we're building with wood, we're leveraging our forests' natural ability to absorb carbon dioxide, produce the oxygen we breathe, and store the remaining carbon dioxide,” says Chouinard. “So, if we're using wood to construct buildings what we're doing is systematically and effectively removing carbon dioxide and storing it in these beautiful buildings.”

In addition to storing carbon, wood products are associated with low levels of carbon emissions during manufacturing, thus reducing the overall carbon footprint of a building's construction. Combined with sustainable forest practices, mass timber could help to reduce the GHG impact of the construction sector, which represents approximately 39 per cent of all emissions globally, according to the 2019 International Energy Agency Global Status report.

The carbon captured by mass timber can be significant, especially in a tall wood building. The SMTC report, for example, notes the 18-storey Brock Commons Tallwood House hybrid mass timber structure, at the University of British Columbia stores 1,753 tonnes of CO₂, while the total carbon benefit created by the tower's construction process is approximately 2,432 tonnes of CO₂—equivalent to taking 511 cars off the road for a year.

“Concrete and steel production, upon

design and construction?

“We have to be looking at the climate impacts right at the very beginning as part of our normal design process,” says Mansac. “Those are the moments at which those critical differences happen and once those decisions are made, often in the first month of a project, they have ongoing impacts for the next 100 years.”

It's critical, she says, for the design team, architects, engineers, and contractors to be part of the solution and to calculate the benefits of mass timber at the same time they're thinking about building and wind loads.

“And when we do, wood comes out ahead almost every time.”

Building with concrete and steel is very labour intensive and time-consuming processes.

But if you can take a product like mass timber, says Bowerbank, assemble it and build it in a factory and then ship it to site for a prefabricated, modular system that goes up quickly, you are automatically reducing carbon emissions during construction.

“We have so much still to learn and understand about the entire process, but it's going to be a fun ride figuring it out.”

Building the code

The federal 2020 National Building Code, delayed until later this year, is expected to allow mass timber construction up to 12 storeys.

Unfortunately, says Mansac, most tall wood buildings still have to be encapsulated.

“We'd like to see the next iteration of the code where you no longer have to encapsulate the wood and you can actually show it.”

If encapsulation wasn't required it would reduce costs because fewer trades would be required to finish the building without the need for drywall and other materials, says Mansac.

“The current code is a good stepping-stone, but I don't think it's going to make a big difference because not many more people are going to be excited about wood if they have to encapsulate it. I'm waiting for the next code.”

It's also going to foster investment in innovation, research, development, and testing. And that will lead to the introduction of new and complimentary engineered wood products, which will force designers and builders to be more creative about how they use wood to address the needs of increasingly larger buildings. ♣

Combined with sustainable forest practices, mass timber could help to reduce the GHG impact of the construction sector.

a building—will be one driver for mass timber adoption as we strive to achieve net zero.

“The perceptions of green and sustainable and low-carbon tend to move around based on what elements we have to tackle,” says Bowerbank.

Ten years ago, he says, it was around operational carbon, which is emitted from the annual running of a building: typically, from the electricity and natural gas required to heat, cool, ventilate, and power the building.

“Now it's really about the material itself and the embodied carbon sequestered inside.”

which we have relied for the last 150 years to build cities, is the leading cause of the world's current CO₂ crisis,” says Chouinard. “As the world rapidly approaches nine billion people—three times what it was in a less than a single lifetime—our fragile planet is desperate for sustainable alternatives and mass timber will be an essential building material of the 21st century.”

Early adoption

Where can the efficiencies and carbon reduction be made during the stages of

John Tenpenny is the editor of ReNew Canada.

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B.C.'s Biggest Clean Energy Project

This shell-shaped object is the Unit 1 spiral case being installed at BC Hydro's Site C Clean Energy Project. It regulates water flow and pressure into the turbine. Crews are currently installing the components for Units 1, 2 and 3 inside the Site C hydroelectric generating station. — **Staff**

Send us your best infrastructure image, and you may see it featured here. Email Editor John Tenpenny at renew@actualmedia.ca for details.

Credit: BC Hydro





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Our water infrastructure systems are aging and in dire need of repair, with many of the pipes past their service life.

DIGGING DEEPER

Managing utilities poses one of the largest risks in urban construction.

By Richard Harris

Beneath the ground or towering overhead, every urban centre has hidden networks of cables and pipes that keep us connected. If a construction project jeopardizes this delicate utility network, the community risks losing the power, telecom, water, gas and drainage services that are so integral to our daily lives and businesses.

Before you ever break ground on a project, you need to know exactly what exists underground and overhead, and how you'll manage that infrastructure. This enabling works strategy involves many stakeholders and requires a high level of partnership and accuracy to succeed.

Despite various planning and utility relocation guidelines, the challenges surrounding utilities coordination exist across construction projects in every Canadian city. By exploring examples of real-world risks and approaches to utilities management, we can identify the tactics that are working well and build a concrete set of best practices to better manage this complex issue.

What is utilities coordination?

The Transportation Association of Canada defines utilities coordination, or utilities management, as “the coordination of projects between public land authorities and utility service providers. [It's a] process [that intends] to provide early identification and resolution of possible delays and confusion that may add unnecessary complexity and cost to a project.”

Consisting of key planning, design and construction phases, utilities coordination is a project in and of itself. Ideally complete in the years leading up to the main construction project, utilities coordination enables the project team to begin construction with clear pathways.

Why is utilities coordination challenging to manage?

Major projects rely on multiple utility agencies and stakeholders coming together to work on a project that is not of their creation. Depending on right-of-way, relocating utilities can come at the expense

of a utility agency, and its preferred solution may not align with the upcoming project's objectives and priorities.

To complicate things further, there's a lack of consistency in how public land and utility agencies operate. The responsibility for utilities management also varies depending on a project's construction approach—often leading to an important question, “How can we best manage utility risks?”

Take, for example, news we've seen about gas mains, water mains and other utility infrastructure that have been adversely impacted by construction, causing major service disruptions, traffic delays or worse.

A Light Rail Transit (LRT) project in eastern Canada faced these challenges. To mitigate roadway closures, a section of the project was bundled with a highway expansion project. With multiple stakeholders involved, the project teams and road authorities came together to complete the necessary enabling works. Despite best efforts and cooperation from the utility agencies, the contractor struck a gas main during construction—leaving a major

highway inaccessible for several hours while the pipe was repaired.

So, how did this happen? The design and construction works were well coordinated, but the discovery that the as-built drawings on file were slightly off came too late. As-builts are vital to locating existing utilities. Many municipal and utility agencies keep them readily on file for this purpose. The accuracy of these files, however, can vary based on the agency's administrative and quality assurance protocols.

Was this avoidable? Yes.

Inaccurate or incomplete as-builts are one of the known risks that a project may face. Although not the sole cause of coordination challenges, uncertainty, inconsistency and lack of rigour surrounding who should own and manage utilities coordination, as well as related issues resulting from insufficiently informed contracts, can lead to project delays and high project costs. As a result, contractors are becoming more reluctant to bid on major projects where they are expected to assume utility risk, as the stakes are just too high.

When utilities coordination goes wrong

This experience is a common example of what can go wrong with utility coordination, despite the best of intentions. But what happens when planning and communications break down or self-interests conflict?

When it comes to utilities, the preliminary planning and enabling works that go into a project can greatly impact the overall schedule and budget. A project's enabling works rely on the successful engagement and cooperation of all impacted utility agencies, road authorities and/or stakeholders. In some cases, there is very little guidance on how to best engage these agencies, so it's not only natural, but a fiduciary duty, for each

three project teams came together to manage utility relocations and enhancements as a key part of the program's scope of work. Despite this early acknowledgement, the program has progressed substantially through design and has been under construction for more than two years, with outstanding issues surrounding agreements for cost sharing, coordination and integration of utility design.

Discussions with utility agencies started

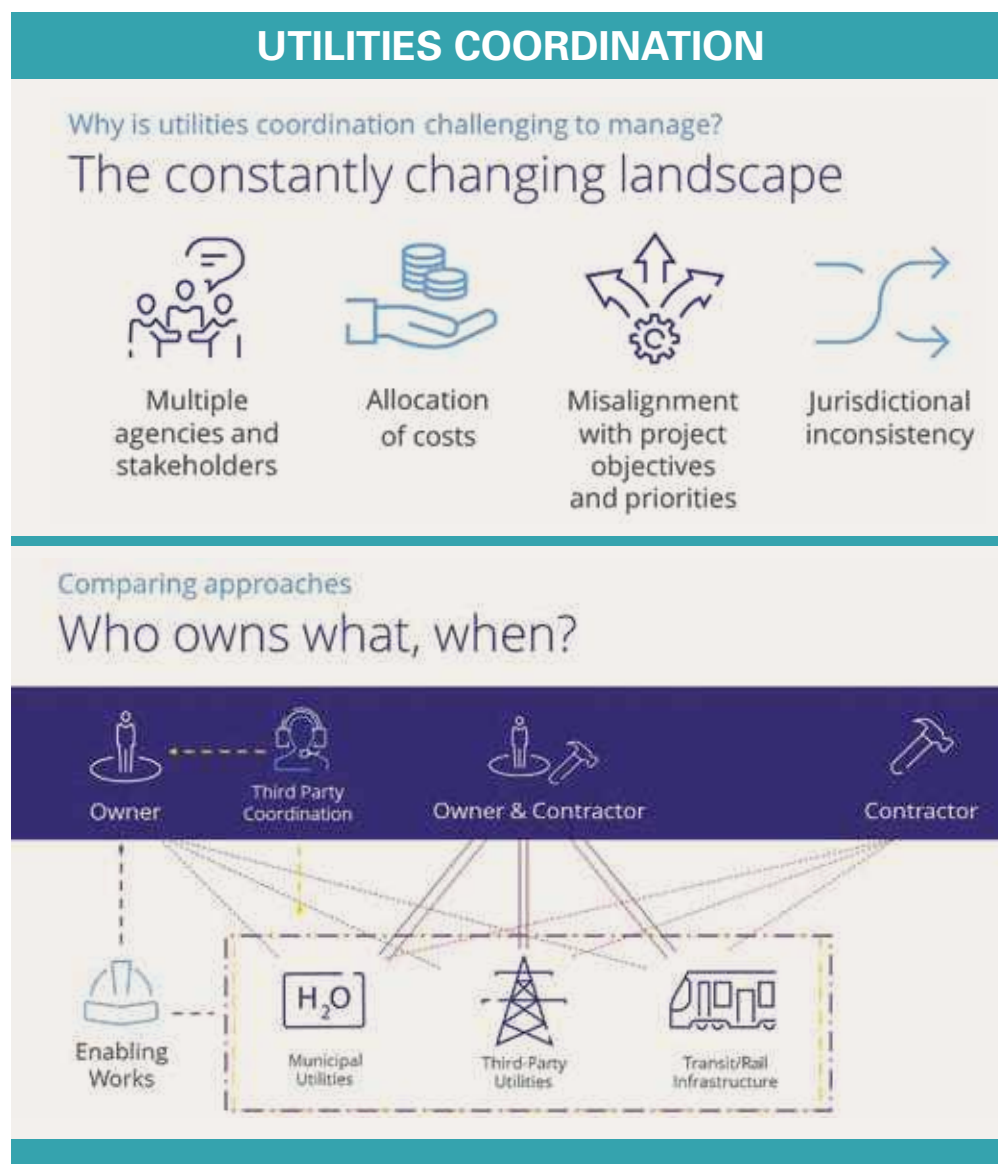
Coordinating and managing utilities poses one of the largest risks in urban construction today.

entity to focus on priorities and projects that serve their respective interests.

This is the case for a major program of work in central Canada, where utilities coordination has been on the critical path and continues to have a significant impact on cost and schedule. The utility agencies involved provide vital infrastructure to support the city but are governed by complex regulations and agreements that are often outside the project owner's direct control or influence.

In the earliest stages of design development,

early, but the identified solutions extended project timelines and exceeded the owner's budget. Protracted negotiations began with the expectation that the program owner would fund most of the costs, including some of the aging utility infrastructure replacements. Design restrictions imposed by the utility agencies, like tethering to existing structures or installing below new construction, limited technical solutions. Ultimately these complications resulted in a need to seek legal representation to reach a resolution.



Utility coordination has both complex technical and legal requirements. Understanding the impact of pre-existing utility agreements, overarching utility plans and stakeholder priorities needs to be factored into a project plan early on, along with risk mitigation strategies.

What's been working well?

Having a firm understanding of utility risks, and assigning those risks to the parties best able to manage them is a common strategy. How you approach utilities coordination can make a big difference as well.

With so many stakeholders, agencies and regulatory authorities involved, a utilities coordinator or coordination team must maintain clear and consistent lines of communication. The two examples we've explored so far represent very different approaches—one placing the coordination responsibility on a single entity, and the other consisting of three separate teams coming together to coordinate the utilities on a project.

Simplifying the coordination approach and limiting responsibility to a single entity gives everyone on the project a single point of contact for communication. If the entity

Before you ever break ground on a project, you need to know exactly what exists underground and overhead.



providers, regulatory agencies and impacted stakeholders. Consider creative strategies such as seconding and co-locating utility staff to effectively engage and align third parties.

3 Invest in locates/as-builts: survey, map, locate and update all utility records in the right-of-way and vicinity of the project. Use technology, such as GIS and GPS, to improve accuracy and transferability.

4 Have a plan: build a utilities-specific risk management plan that identifies solutions to mitigate both known and unknown risks. Update and report on the plan regularly over the life of the project.

5 Define the budget: outline anticipated relocation costs based on the plan, and allocate contingency funds for both known and unknown risks. Be cognizant of existing agreements and transparent with stakeholders, third-party utilities and funding partners regarding cost responsibility. Consider a project contingency for unknown utility risks that falls in line with existent or non-existent agreements between the parties.

6 Prepare for conflicts: familiarize yourself with the agreements, laws, regulations and right-of-way proceedings related to utilities coordination. Prepare a governance plan to clearly define the roles, responsibilities and contractual obligations of each stakeholder, third-party agency and authority. Identify a swift means for escalation and resolution.

7 Avoid transferring risk to the contractor: allow the main contractor to manage utility relocations only if they have negligible risk, are within the owner's right-of-way, and it is more efficient and cost effective for them to do so. If this is not the case, the responsibility of the relocate should default to the owner, thereby minimizing project risk.

Although there's no panacea to solving this large and complex issue, utilities coordination is becoming widely recognized as a key project component, and as one of the largest risks facing major urban construction projects today.

By listening and learning from others, we can build on practices that are working well, avoid demonstrated pitfalls, and develop a measured approach to managing utility risks that serve the best interests of the project and all stakeholders. ♣



Richard Harris leads Colliers Project Leaders' Infrastructure team across Canada.

responsible for coordination can dedicate a team to focus solely on utilities management, all parties can benefit. Without the added pressures of managing utility risks, stakeholders, consultants and contractors can focus on their areas of expertise and the primary project goals.

Identifying a single entity to manage utilities also enables that team to consider the bigger picture. In urban centres, there are often several construction projects underway. By considering current and future projects that

manager is able to leverage the city's pre-existing relationships with third-party utility agencies, which is helping them achieve desirable results.

The term of many major transit projects is often so long that other impacting projects must be considered. By factoring in upcoming projects along the alignment, the team can better interpret future utility needs with each provider and mitigate the risk of continuous utility rework and ongoing disruption in the coming years.

Identifying a single entity to manage utilities also enables that team to consider the bigger picture.

are likely to draw more power or place a higher strain on the existing utility infrastructure, the coordination team can approach utility agencies with a comprehensive plan that's likely to benefit all parties.

This is the approach a western Canadian city is using for its new LRT project. The city acknowledged the cost and schedule risk associated with delivering the utility relocation work as part of its main contract. On this basis, it selected a construction management approach, engaging the expertise of the contractors in the pre-construction phase, allowing for single entity utilities coordination. Working as an extension of the city, the construction

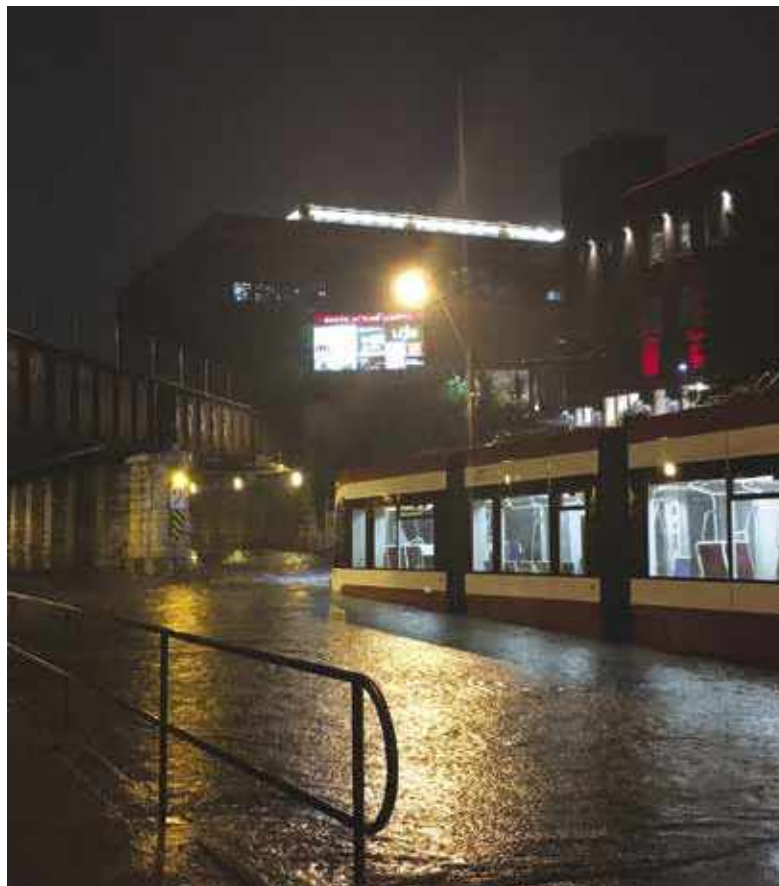
In most major urban centres, cost sharing is governed by municipal bylaws. This may reduce the cost risk to the owner, but working collaboratively with third-party utilities can further reduce the broader cost impacts of disputes, delays and claims.

Minimizing risks

There are several steps project owners can take to reduce utility coordination risks.

1 Start early: enticing all parties to share their five to 10-year capital plans is a good starting point.

2 Dedicate a team: identify and dedicate a team to manage utilities coordination and invest in your relationships with third-party utility



Sustained funding needed for water infrastructure, new RCCAO study says

The labyrinth of pipes that we rely on for delivery of our drinking water and removal of wastewater are often out of sight and out of mind, but they are essential to our well-being and must be kept in good repair.

However, a study done for the Residential and Civil Construction Alliance of Ontario (RCCAO) suggests that many of our pipes and watermain are past their service life and we're not doing enough to replace them.

The study, called *Water Infrastructure in the 21st Century: Smart and Climate-Savvy Asset Management Policies*, was done by University of Toronto professor Tamer El-Diraby. His research indicated that millions of cubic metres of drinking water go to waste every day in Ontario due to leaky watermain.

Many municipalities report an estimated leakage rate of at least 10 per cent, but reports by consultants who did actual assessments show that rates in Ontario could be as high as nearly 40 per cent. An analysis for the Town of Smiths Falls estimated that rates between 2003 and 2019 ranged between 41 and 67 per cent.

The City of Toronto has consistently reported a leakage rate of 10 to 15 per cent, which means it wastes 103 million litres a day. The volume is equivalent to filling more than 15,000 Olympic-sized swimming pools every year.

These are alarming numbers that indicate we need to continue investing into the repair and replacement of this vital infrastructure. In Toronto, 16 per cent of the watermain are 80 to 100 years old and 11 per cent are more than a century old. RCCAO is calling on governments to provide sustained funding to fix and replace these assets. It is incredibly inefficient when treated drinking water never makes it to the taps because of leaky pipes.

There are significant economic gains to be made from repairing the systems. Fixing leakage in a single section of the water system in York Region, for example, saved 139,000 cubic metres a year in water, and \$426,000 annually in costs.

Governments must stay the course and continue to provide funds to municipalities for these critical assets as well as embrace new asset management practices to make this infrastructure more resilient and future ready.

Visit rccao.com to find out more.



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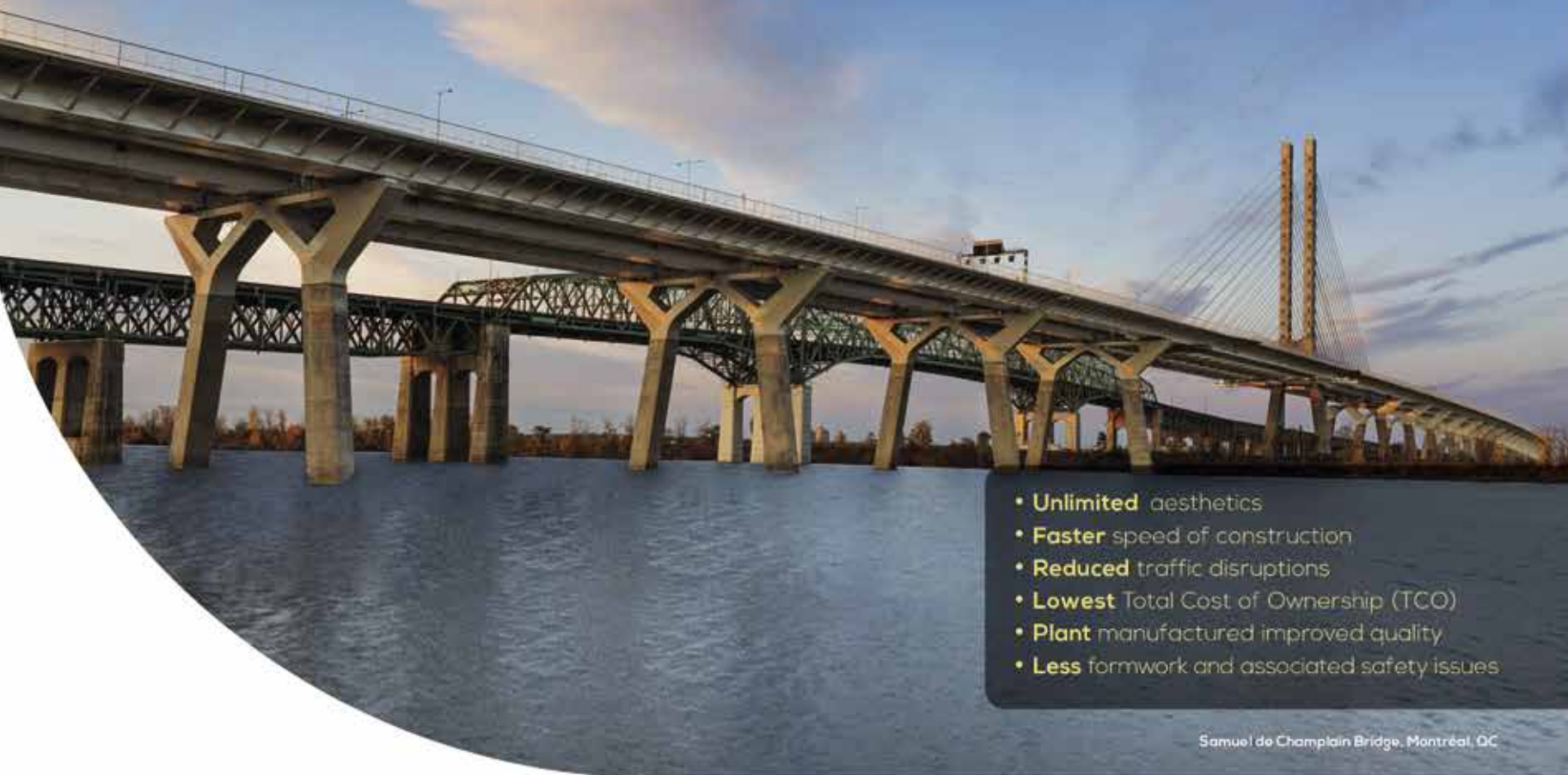
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Short-rotation crops such as hemp and bamboo offer a future building materials solution that can also help to store carbon.

REDUCING EMBODIED EMISSIONS

Achieving net zero in Canada's built environment. *By Will Nash*

The materials that we use to shape the built environment are largely human produced—and it can be easy to forget that all the ingredients that go into those materials come from the earth. Materials production in 2021 is the greatest burden on the planet, destroying large swathes of the natural environment, producing mountains of waste and generating vast quantities of harmful emissions, including carcinogens, poisonous byproducts, and of course, global warming gasses. Production of materials is not just causing emissions, but reducing the capacity of natural systems to remove them from the atmosphere.

As Canada strives towards its net zero targets in the decades ahead, how will the production of materials for the built environment find ways to reduce its carbon footprint?

Available solutions

The most effective method to reduce the emissions from construction materials

doesn't come from materials technology at all; it comes down to planning. After all, the most sustainable building is the one that is never built.

In the early 1970s, the Earth Day movement introduced the three Rs to the general population: reduce, reuse and recycle. These are still applicable today. But instead of focusing just on waste, we need to apply them to consumption.

the (hopefully) little that remains. This is important because even if we decarbonize our materials completely, we are still facing the collapse in biodiversity caused by excessive consumption, so the number one goal should be to use what we already have. There is a general misconception that technology will save humanity, typically with some sort of carbon dioxide sucking machine or geoengineering,

We need to ensure that our built assets are sufficiently durable, maintainable and ultimately reconfigurable to reduce future demand for materials.

It's also important to remember that they are hierarchical goals. Much of the emphasis has been on recycling, but before that, we should reduce consumption and reuse items as much as possible, recycling

but technological fixes are not enough to solve the problems we face which, at its core, is a crisis of overconsumption.

We see some cities adopting carbon efficiency measures, and for embodied



Working towards net zero includes improving the circularity of the building materials, having a plan for how the products will be disassembled and reused at the end of the asset's life.

Credit: WSP Canada

carbon the City of Vancouver has committed to a 40 per cent reduction in $\text{kgCO}_2 \text{ e/m}^2$ by 2030. This is a great step and should be applauded. However, if the city keeps on growing, we risk nullifying the impact of the action. What we expect to see in the carbon constrained economy is an implementation of carbon budgets, which will force planners and developers to prioritize refurbishing and repurposing existing assets.

The other big change occurring is increased renewable energy and electrification. Saul Griffiths' 'Rewiring America' analysis of the U.S. estimates that electrification of everything would reduce emissions by 40 per cent. With the price of renewables already below existing fossil fuel with further falls to come, the switch to renewables will be rapid. Materials emissions will fall thanks to electrification of industry and transport, so long as electricity is produced by renewables. Canada already has some of the cleanest electricity in the world and should be leveraging this advantage to produce low carbon materials for export. The Elysis pilot in Quebec is already producing zero emissions aluminum and Wanipigow Glass in Manitoba is expected to begin producing low emissions float glass in 2022.

We should be proud of the Canadian government for implementing the carbon tax, which will be a driver for decarbonizing materials, and will position Canada well in a carbon constrained global economy. However, the government also has a massive role to play in providing a just transition for workers in climate exposed industries, including fossil fuels, petrochemicals and forestry. Innovations in new materials and resource flows can support these actions.

forests. Old growth logging is the largest emitter of carbon in Canada, not only due to slash burning, but the loss of soil carbon stores, and arguably the increased risk of forest fire and beetle infestation due to logging. Balancing social and environmental needs is not going to be easy, and protecting the old growth forests in the long term needs well thought out incentives to prevent land clearing for other uses.

There is a movement to store carbon

With low carbon grids already in B.C., Manitoba,
Quebec and Ontario, Canada is poised to be a global
leader in the production of low carbon materials.

Increased integration of low embodied carbon materials will help reduce emissions, but must be considered early in the design phase of the project. However, it's also important to recognize that mass timber materials, the use of which are on the rise in Canada, need to come from sustainably-sourced plantations versus old-growth

in building using biogenic materials, timber being the most familiar and ancient building material. However, when a tree is felled only roughly 20 per cent of the timber makes its way into long term use as furniture and buildings. A better strategy is using short rotation crops—Canadian researchers including Geoffrey Guest and

Chris Magwood have shown how building materials made from agricultural waste from grains and cereals can sequester carbon for as long as the products are in use. If manufacturing emissions are minimized this is very promising for the building industry, and could be a boon for producers in the prairies.

Next generation solutions

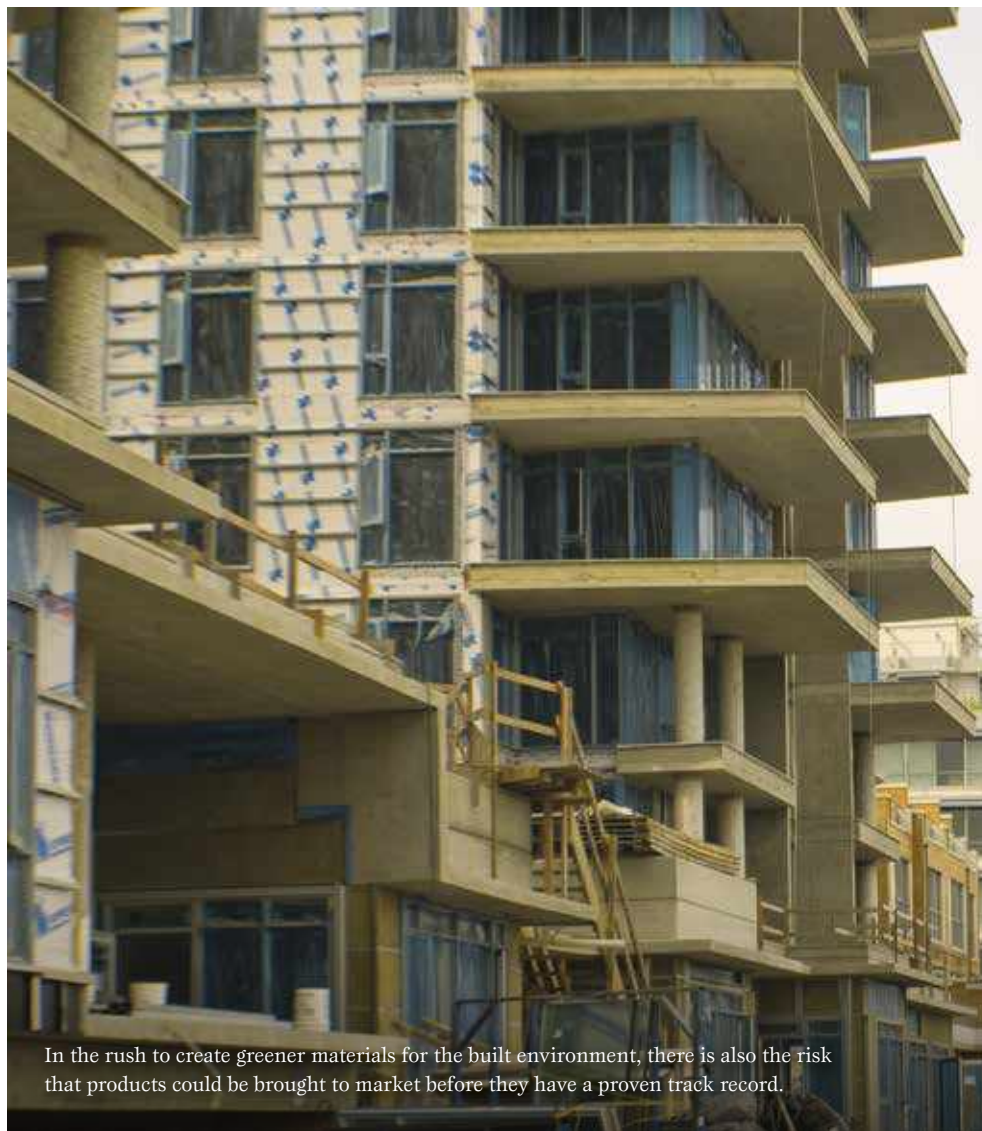
Solutions for reducing the embodied carbon of the big emitters of steel and concrete are desperately needed. In Germany and Sweden, hydrogen-reduced steel is being piloted and should eventually lead for zero emissions steel once the green hydrogen supply chain is established. Alkali-activated materials to provide low carbon concrete are well into development, and in fact have been used in various formulations since at least the 1930s. Alternative cement replacements like ground glass and volcanic tuff are also being adopted in various regions. Another promising area is a return to more traditional building materials, straw bale, hempcrete, adobe and rammed earth are great materials with long histories using locally sourced inputs with very low emissions, again Canadian researchers and innovators are leaders in this field.

There is exciting research about using microbial grown cements, artificial photosynthesis for organic chemistry, genetically engineered crops to produce high value fibers like spider silk, and producing carbon nanotubes from atmospheric CO₂. As these technologies develop from bench-scale to commercial-scale production, they all can further reduce the emissions associated with building materials.

We need to ensure that our built assets are sufficiently durable, maintainable and ultimately reconfigurable to reduce future demand for materials. Part of this involves using a unified system for capturing design information, tracking construction and procurement, through maintenance and ultimately to disassembly—BIM and digital twins are tools we can use today to make it easier for future generations. By taking steps to improve the circularity of the materials economy, using buildings as “materials banks” and incorporating design for disassembly and reuse, there are real measures that designers can implement today to reduce resource use in the future. For the very hard to decarbonize materials like concrete, these strategies can help.

Challenges ahead

Making the necessary adjustments to reduce emissions towards net zero in materials production will not be a simple feat,



In the rush to create greener materials for the built environment, there is also the risk that products could be brought to market before they have a proven track record.

as they're as difficult obstacles to overcome in the process.

Most of the challenges are to do with bureaucracy, establishing supply chains, allowing flexibility in engineering standards, and upsetting the status quo. Lots of incumbent producers have invested massively into their production pipeline. Resource extraction and transportation emissions are not entirely within the industry's control, and manufacturers need to demand more sustainable supply chains to improve their products.

Greenwashing also remains a risk, as companies may overstate the emissions reductions they are achieving. There is a risk that this could happen, both in the production and extraction of materials.

In the rush to create greener materials for the built environment, there is also the risk that products could be brought to market before they have a proven track record. This has occurred before, polybutylene water pipes as an example, where unproven products have been rushed to market before adequate testing. To ensure lower emissions products are widely adopted by the industry rigorous testing programs are required.

It will take changes from governments at

all levels to meet the demands of reducing carbon emissions in materials processing and production. It will also mean that companies already entrenched in these industries will have to make significant adjustments to their operations, something that may require legislation to enforce.

With low carbon grids already in British Columbia, Manitoba, Quebec and Ontario, Canada is poised to be a global leader in the production of low carbon materials.

Prioritizing embodied carbon reduction on our projects gives us the best chance—this needs to be front of mind during the conception stage. As engineers, we can take a leading role by developing performance-based specifications that target low embodied carbon, and using novel materials in non-critical areas so that long term performance data can be gained to improve performance and confidence. 🍁



Will Nash is the team lead - materials performance for WSP in Canada.

Early Construction Involvement led to several design improvements generating nearly \$2 million in savings.

Credit: Graham Construction

EARLY ADOPTERS

Building risk-reducing processes into construction contracts.

Amidst the daunting choice of complex contracting forms and execution models facing project owners in today's construction environment, one approach stands out for its simplicity, adaptability and effectiveness: early construction involvement (ECI). The City of Calgary's \$61 million interchange project at Macleod Trail and 162nd Avenue SE illustrates the ECI concept in action and the benefits it can generate.

By adopting an ECI structure and working in good faith towards a common goal, the three key parties—project owner, design consultant and construction contractor—executed a complex and innovative “diverging diamond” interchange—the first of its kind in Canada. It replaced a heavily congested signalized intersection on budget, ahead of schedule and without interrupting traffic on a busy artery. The ECI approach not only identified cost-saving improvements, it helped overcome the effects of unusually wet weather that could have delayed the project by a full year. ECI thereby demonstrated its utility in addressing risks ranging from fine-grained to project-threatening.

“ECI originated as a tool to accelerate

schedule and leverage the expertise provided by the contractor. Time was of the essence on this project,” notes Chris Delanoy, P.Eng., managing director, Calgary for ISL Engineering and Land Services Ltd., the interchange project's lead consulting firm. ISL has participated in ECI contracts since 2010. “We like this approach, and it was well-suited and very successful in this case,” Delanoy adds. “ECI creates opportunity to start work before the design is fully completed and provides us with valuable input from the people who actually have to build the project. This provides better value, helps get the project going and keeps it on-schedule, and reduces the risk of costly rework.”

A common goal

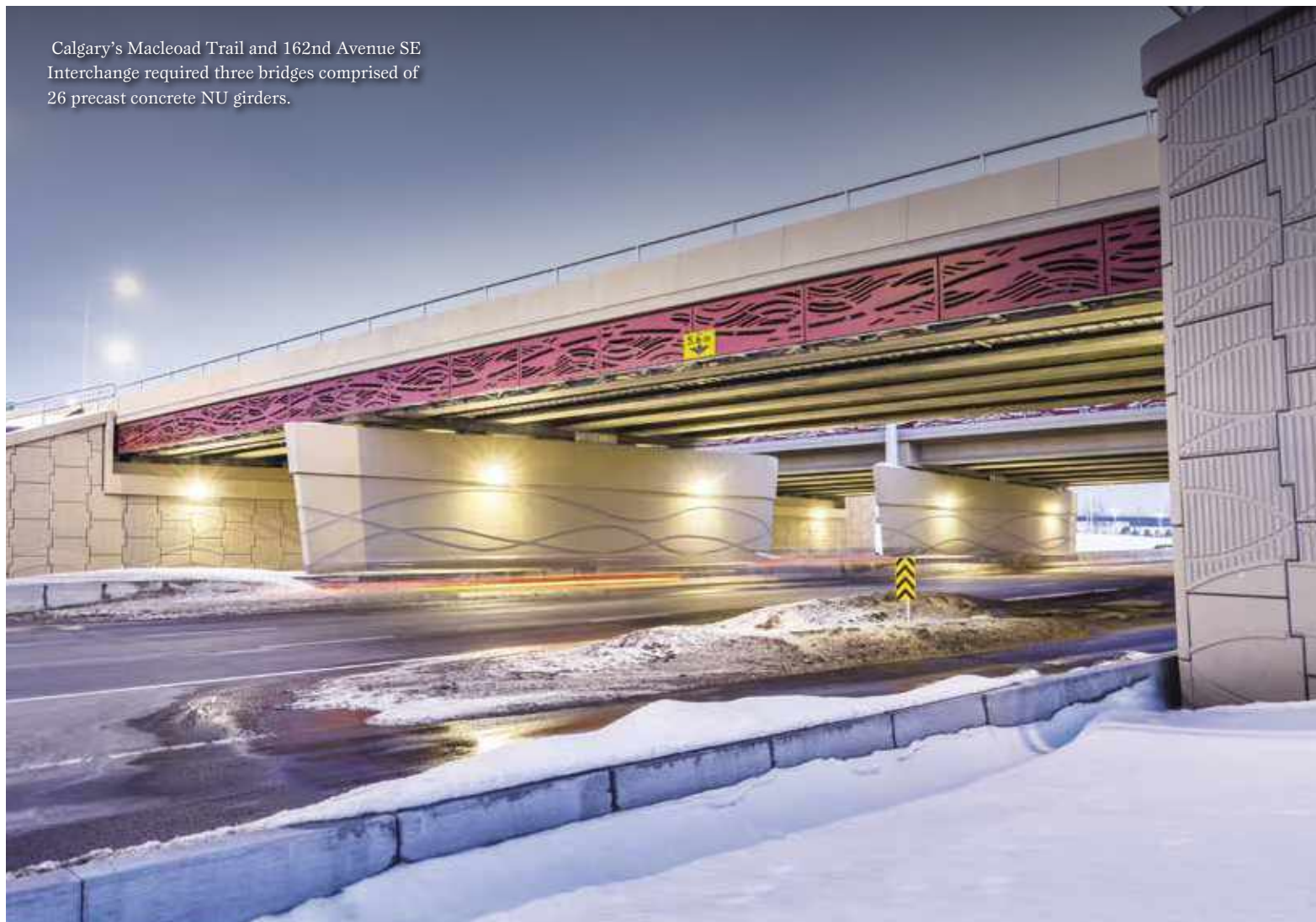
ECI is not a separate category of construction contract. Nor is it a comprehensive new execution model. Instead, it modifies existing contracts and execution models to create a collaborative environment. It takes place primarily at the senior project management level, where client, consultant and construction provider come together. It can therefore be applied to several

established contracting forms. ECI's primary characteristic is to contractually bring the construction provider into the process before the design is complete and to provide direct incentive by letting them share the benefits of the value the process creates.

In the case of Macleod Trail and 162nd Avenue SE, that was at about the 60 per cent design stage. Once the contractor is on-board, there is a formal process that enables the three key parties to assess constructability, discuss feasibility and identify problems before the design is fully complete, and also identifies critical-path work that can begin concurrently while the rest of the design is finished. It facilitates jointly solving problems, lowering risks and optimizing design, all before any costly rework and change orders are triggered. This also protects the schedule. Making ECI work requires a project management approach with frequent technical working meetings.

The success of this approach, in turn, hinges on several intangible but essential characteristics within each party. In addition to assessing whether their project calls for ECI, the owner or their representative must carefully evaluate potential engineering/

Calgary's Macleod Trail and 162nd Avenue SE Interchange required three bridges comprised of 26 precast concrete NU girders.



design firms and construction providers for suitability as ECI participants. Establishing the collaborative nature of the working management team is critical, for ECI breaks down without trust and mutual effort towards a common goal. The owner must be willing to share risk and provide financial incentives. The designer must accept and incorporate feedback in order to optimize constructability. The contractor must be genuinely willing to share ideas and information in a spirit of partnership and must have suitable personnel

ECI's origins go back to the U.K. in the 1990s, where ECI was mainly incubated in the private industrial sector, in which owners are free to select providers based on technical qualifications rather than through competitive bidding (such a process can, of course, carry risks for the owner). Typically, ECI contracts stipulate financial incentives for certain innovations or problem-solving, by directing a portion of the costs saved to the designer or construction provider.

ECI made its appearance in Canada

only a limited set with a demonstrable track record of successful delivery.

The three requirements that typically signal the need for ECI are overall complexity, a critical schedule and a challenging operating environment. All three coinciding create the classic ECI setting. Increasing project complexity heightens risks of things going wrong and the schedule slipping. If maintaining schedule is critical, then a three-party relationship optimized for proactively solving problems is clearly needed. A challenging operating environment has several effects. First, it increases the chances of problems arising. Second, it complicates maintaining the project's schedule. Finally, it heightens the risk that a pre-finished design will be ill-suited to the as-built environment.

ECI creates opportunity to start work before the design is fully completed and provides us with valuable input from the people who actually have to build the project.

Passing the test

The Macleod Trail and 162nd Avenue SE interchange illustrates the theoretical framework in practice. It required designing and building around existing infrastructure, including two major roadways, and numerous underground utilities including storm drains, large sanitary sewers, water feeder mains and major telecom lines. The owner required that traffic averaging nearly 100,000 vehicles per day not be interrupted, and that the first of three bridges be up and

with strong technical construction skills and excellent interpersonal skills needed for effective collaboration.

In Delaney's view, Graham demonstrated the required characteristics. "Graham's team embraced the process and helped generate real savings in excess of the financial incentives that were available, showing that they were genuinely interested in getting to the best result for the owner," he says.

approximately two decades ago. While it is still not particularly common, it is regularly adopted for industrial projects (especially oil and natural gas-related), construction of buildings, as well as on water/wastewater projects, but less so in other infrastructure. While the majority of North America's larger, more sophisticated construction and engineering companies would say they are comfortable in an ECI setting, there is still

Calgary's Macleod Trail and 162nd Avenue SE diverging-diamond interchange was completed seven months ahead of schedule.



More important, however, was how the team dealt with unforeseen events that could have imposed massive new costs. “It proved to be one of the wettest summers on record,” says McKay. By late summer, the first season’s work had fallen nearly one month behind schedule. The overall threat, however, was considerably greater than that. As McKay explains, “If we hadn’t gotten that first bridge done in the first season, it could have pushed the entire project into a third year—meaning eight to 12 months of lost time.”

The team’s recognition that the schedule was at risk prompted design changes to the utility and detour works to avoid certain conflicts and also led Graham to increase significantly its deployed resources. The company’s depth enabled it to smoothly scale up to 24-hour shifts for some tasks and 12-hour shifts for others, making up well over a month in under three months of intense effort. The result: without impairing project quality or safety, Graham actually beat that year’s November deadline, and Macleod Trail became free-flowing in mid October.

A “Goldilocks” project

The following September, the Macleod Trail and 162nd Avenue SE diverging-diamond interchange was officially completed, seven months ahead of schedule. The City of Calgary was pleased. “The project and the approach taken were very successful, and we’re very happy with the end result,” stated Kara Wolfe, the project manager with Calgary’s Transportation Infrastructure group, shortly after the project was completed. “I see the value in ECI and I would definitely do it again.”

ECI is not suited for every type of construction project. “If a project is too small, ECI can be overkill and might actually slow it down,” says Delanoy. “If a project is megascale, ECI alone might not provide enough information to do everything right.” Very large projects may call for more intensive and continuous process of collaboration and innovation throughout the project’s lifecycle. Delanoy sees a mid-sized range of “Goldilocks” projects where ECI is “just right” for the overall scope and the scale of risks and challenges. In summary, ECI can be best seen as a notably useful and, in selected instances, decisive tool with which an owner can reduce risks, overcome problems and bring a major project to fruition on-time and within budget. ♣

**This case study was submitted by
Graham Construction & Engineering
Inc. of Calgary, Alberta.**

functioning as a temporary overpass before the first winter, so that north-south traffic on Macleod Trail could become free-flowing. And the physical work all had to take place in two main construction seasons plus one winter—only 19 months in total.

“We examined aspects of constructability and looked for areas where we could save costs or make changes that improved the schedule, or that helped mitigate issues in other areas that arose,” recalls Bryce McKay, P.Eng., Graham’s senior project manager on the interchange. “Coming in after the design process is complete, as we

Identifying a problem is one thing; resolving it and delivering the physical result is another. The construction provider in an ECI arrangement must have the full range of resources—project management, multiple disciplines, subject matter experts, organizational efficiency, surge labour capacity, access to materials and equipment—needed to use the information the process identifies and solve problems effectively, efficiently and safely and without creating new risks.

The interchange project put ECI and Graham to the test. Several design

Coming in after the design process is complete,
as we would in a traditional contract, would be too late
either to suggest improvements or to implement them.

would in a traditional contract, would be too late either to suggest improvements or to implement them.”

Graham offered the city and ISL its extensive experience with ECI. “The construction contractor is actually able to support the design and not merely carry it out as best we can,” adds McKay. “With everyone working collaboratively instead of having an adversarial relationship as in certain types of contracts, ECI helps put the risks in the proper ‘buckets’, supports fast-tracking a job and getting a difficult job done successfully.” All within a relatively straightforward, stipulated-price contract.

improvements saved the city nearly \$2 million in total. Graham provided design reviews, value engineering, constructability proposals and detailed schedule planning broken into seven phases. Among the resulting improvements were input on construction sequencing that reduced by half the temporary shoring wall required for pile installation, reduced the undercut on MSE walls, and rerouted a detour ramp to avoid rebuilding a major drainage feature. The innovations helped meet the overall objectives including opening Macleod Trail to the free-flowing traffic a full year ahead of construction completion.

Can Data Help You Find Your Next Customer?

Trillions of dollars are invested every year in all areas of infrastructure by tens of thousands of potential buyers. To best serve cities and utilities and to deliver solutions to their most pressing infrastructure challenges, vendors, service providers, engineering firms, and construction firms need the right insights to develop relationships and close deals in a proactive way, before the RFPs, not during.

Historically, the industry has relied on existing relationships, trade shows, and third-party sales channels to gather this intelligence. Now, a digital alternative exists. Cities and utilities generate mountains of data **in council meeting minutes, infrastructure plans, engineering studies, budgets, compliance violations, capital improvement plans, public notices, and more.** Early stage intelligence collated from these sources provides a window into future opportunities, whether they've been realized by the public entity yet or not.

Early stage intelligence allows industry professionals to:

- Get ahead of the RFP and position themselves for the win.
- Focus time and resources on better opportunities instead of more opportunities; and
- Identify strategic initiatives for niche markets or geographic growth.

It also allows professionals to remain up-to-date on project opportunities as timelines evolve and projects move from stage to stage (for instance, master planning to feasibility studies, environment assessments, and funding applications).

Success with Early Stage Intelligence

Citylitics delivers predictive intelligence on upcoming infrastructure project opportunities to hundreds of business development teams. The following are some best practices we've seen generate success with early stage intelligence.

Educating and Engaging with Communities in Pre-Planning Stages

Communities aren't always aware of what infrastructure solutions exist, let alone where to start, meaning that industry professionals need to focus on educating prospects on available solutions, the benefits of private-public partnerships, and unique differentiators. By beginning with a targeted list of upcoming project opportunities, Orenco can allocate their time and resources on the education process vs. vetting prospects. For companies as nuanced as Orenco whose solutions aren't taught in engineering schools, educating people on the range of solutions and differentiators is a critical aspect of new business.

"Sometimes the best time to engage with a community is when they're first discussing how to get a sewer system and Citylitics' early stage intelligence gives us the ability to do just that."



Mike Saunders,
National Sales
Manager of Municipal
and Commercial
Systems at Orenco

Early Stage Intelligence as Speaking Points

Knowing a public entity's pain points, steps they've taken, and their concerns is critical when turning infrastructure project opportunities into qualified leads. Mueller's sales managers have found success in diving into the source document links as part of their Citylitics Intelligence Reports to pull relevant speaking points ahead of reaching out to prospects. These tailored speaking points allow them to establish credibility with public entity from the start and partake in more meaningful conversations.

Proactive Management of Rep Networks

For companies that work with independent rep networks, it can be a challenge to stay informed on all potential leads and quickly communicate key information to reps to begin prospecting. Evoqua Water Technologies leverages Citylitics Precision Targeting Reports which provides a succinct overview of the public entity's pain point as a 'trigger' for a project opportunity, the engineer, facility size, and opportunity name. By providing their rep network with actionable information on new opportunities in the early stages, they work to influence development of the specification and place themselves in a better position to win.

Summary

Over the next few years, the infrastructure industry will see an expansion of investment, driven by factors such as stimulus programs, the evolution of cities, and need for resilient infrastructure.

Early stage intelligence has become a must have for companies in infrastructure industries. It also allows them to succeed in finding their best fit customers, develop profitable relationships before the RFP, and generate millions of dollars in new revenue.

"Citylitics takes care of the leg work so that I only have to focus on building the relationship, establishing credibility, and presenting a solution to get it across the finish line."



Mike Uthe,
Northwest Area
Manager at Mueller
Water Products

"Citylitics delivers early opportunities straight to our sales channel."



Rob Biase,
Northeast Regional
Sales Manager
at Evoqua Water
Technologies



For more information on Citylitics, visit their website at [Citylitics.com](https://www.citylitics.com) or follow them on [LinkedIn](#).

Our water infrastructure systems are aging and in dire need of repair, with many of the pipes past their service life.

THE BIG LEAK

Massive amounts of drinking water are wasted due to leaky pipes.

By Tamer El-Diraby and Nadia Todorova

The extensive underground labyrinth of pipes that routinely bring treated drinking water to our homes and businesses is often out-of-sight and out-of-mind, until a watermain bursts and the taps go dry, that is.

It is much easier, after all, to neglect a hidden network of concealed pipes below-ground as opposed to more visible examples like a deteriorating bridge, potholes in a highway, or downed power lines.

However, it is essential that we keep our critical water and wastewater infrastructure in good repair. If we've learned anything from the last two decades, it is that inadequate investments in water infrastructure only lead to deteriorating assets that can result in public health issues and service quality loss.

Proactive maintenance

Investments in water infrastructure asset management and sustained attention to rehabilitation are the cheaper options. The most effective policy is to proactively maintain and upgrade those assets.

When it comes to asset management practices, governments have admittedly made progress over the last two decades.

Yet, there is significantly more work that needs to be done. We still have a long way to go and there is no reason to slow down. In fact, it should be the reason for doubling down.

Our water infrastructure systems are aging and in dire need of repair. Many of the pipes are past their service life. They were installed decades ago and, given that there is no aggressive program to replace them, their breakage rates will only increase—draining more and more of our efforts, money and energy.

As noted in a study (done by co-author Tamer El-Diraby) for the Residential and Civil Construction Alliance of Ontario (RCCAO), we are simply not putting enough funds and efforts towards replacing our critical pipes and watermains. The study, titled “Water Infrastructure in the 21st Century: Smart and Climate-Savvy Asset Management Policies,” examined the extent of the problem.

The study found that many municipalities report a leakage rate of at least 10 per cent. That means that water leakage prevents at least one out of every 10 litres treated in the province from reaching its destination. Reports by some consultants who conducted

actual assessments show that rates in Ontario could be as high as nearly 40 per cent. An analysis that was undertaken for the Town of Smiths Falls estimated that rates there between 2003 and 2019 ranged between 41 and 67 per cent.

According to the research, the City of Toronto has consistently reported a leakage rate of 10 to 15 per cent, which means the city is wasting approximately 103 million litres of drinking water per day. That's the equivalent of filling more than 15,000 Olympic-sized swimming pools every year.

It is difficult to put an exact dollar figure on the money being wasted by treating water that ends up leaking into the ground, as municipalities—especially the smaller ones—do not consistently collect data on leakage.

We can say, however, that based on the amount of water being wasted and the cost of the energy that's required to treat and then pump the water to its final destination, the amount is substantial.

A lot of energy goes into pushing treated water through pipes. With leakages, municipalities must increase water pressure to prevent infiltration. More carbon emissions result from producing that energy.

Crumbling assets

Equally concerning, is the age of the pipes. A 2018 survey of 308 water utilities in North America showed that the typical age of a failing watermain is 50 years, and that about 28 per cent of all watermains have an age of 50 years or older. In Toronto, 13 per cent of the watermains are 80 to 100 years of age, and 11 per cent are more than 100 years old, so they are in need of replacement.

A survey in 2018 found that Chatham-Kent had the highest portion of its water infrastructure in poor condition. In Windsor, 27 per cent of the asset portfolio remained operational beyond its useful life.

The results of the study indicated that Ontario should stay the course to preserve the value of its water infrastructure assets and embrace new asset management practices to make the infrastructure more resilient.

We must pivot our plans to face the more complex challenges of the 21st century. If we let our guard down, the repercussions will be much higher than the simple issue of crumbling assets and lower levels of services.

Lack of funding seems to be a chronic problem when it comes to fixing water infrastructure. However, we must embrace a

significant paradigm shift in the funding and business models for municipal utilities.

For starters, perhaps governments may consider moving parts of disaster recovery into disaster mitigation funds, and instead look at broadening funding for asset management programs that focus on climate action and innovation. We should also allocate stable funding to support an extended asset-energy-carbon analysis that will define the return-on-investment beyond the financial aspects of asset management projects. Funds, meanwhile, could be provided to municipalities to adopt best practices, lead innovation, and develop plans for investment and performance optimization.

Fixing leakage in a single section of the water system in York Region, for example, saved 139,000 cubic metres a year in water and \$426,000 annually in cost as well as enough energy to power 11 homes for a year.

In Collingwood, finding and repairing leaks reduced water loss by 30 cubic metres an hour, a reduction of about 262,000 cubic metres a year. The City of Guelph was able to save 3.7 million cubic metres of water and more than \$300,000 in electricity costs to treat and pump water between 2006 and

2014 using an international water audit by the American Water Works Association.

The City of St. Catharines, meantime, saw watermain breaks decline to 15 per 100 kilometres in 2012 from a staggering average rate of 45 per 100 kilometres in 2000. The decrease was directly related to an increase in the city's watermain replacement budgets as well as prioritizing replacements.

It is incredibly inefficient and singlehandedly defeating our water conservation goals when treated drinking water never makes it to our taps. While there has been progress on the issue, governments must ensure that water infrastructure management and addressing leakage remain a priority. 🍁



Tamer E. El-Diraby is a professor in the department of civil and mineral engineering at the University of Toronto.

Nadia Todorova is executive director of the Residential and Civil Construction Alliance of Ontario.

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Delivering a better world

Credit: Metrolinx



For information about the annual Top100 Projects report and event, visit renewcanada.net/top100-projects

Top100
Canada's Biggest Infrastructure Projects

Tunnel contract finalized for Scarborough Subway Extension

2021 Top100 Projects Rank: 21
Value: \$3.56 billion

The three-stop, 7.8-kilometre Scarborough Subway Extension is moving quickly toward breaking ground on major construction now that a contract has been finalized with Strabag for the project's tunnelling work.

To deliver the project as quickly as possible for the people of Scarborough, Metrolinx and Infrastructure Ontario have split up the delivery of the project into two contracts—the advanced tunnel contract and a stations, railway and systems contract.

This builds on the progress Metrolinx and Infrastructure Ontario made earlier this

year when they identified Strabag as the team they were in final negotiations with on the advanced tunnel contract. As part of this contract, Strabag will be responsible for designing and constructing the tunnel for the Scarborough Subway Extension. This includes designing and building the launch and extraction shafts and supplying the tunnel boring machine. The community will even have a chance to weigh in on a name for the tunnel boring machine later this year.

“For far too long, Scarborough commuters have unfairly dealt with outdated transit that

couldn't keep up with the growing and thriving communities in Toronto's east end,” said Ontario's Transportation Minister Caroline Mulroney in a statement. “The Scarborough Subway Extension will create thousands of jobs during construction and unlock better access to employment spaces, schools and other key destinations throughout the city.”

Strabag, as a consortium, is made up of a mix of international and local companies who have extensive experience working on other major tunnelling projects in Canada and around the world. 🍁

Credit: BMO



Calgary's BMO Centre expansion breaks ground

2021 Top100 Projects Rank: 85
Value: \$503.7 million

The Calgary Stampede, together with Calgary Municipal Land Corporation (CMLC), marked a significant milestone for the BMO Centre expansion, with crews breaking ground on the new facility on Stampede Park—a \$500 million project in Calgary's developing Culture + Entertainment District.

The pre-construction phases have rolled out smoothly over the past 24 months. The Calgary Stampede and CMLC chose the design team in Spring 2019 and revealed the facility's transformative design in June 2020, followed by construction of Hall F through the summer of last year. Crews have worked to prepare the site with extensive utilities

upgrades and demolition work over the past year, readying the convention centre for its 560,000 square foot expansion.

“The BMO Centre expansion will provide state of the art facilities for community engagement and economic benefit through job creation and tourism,” said Steve McDonough, president and chair of the Calgary Stampede. “The expansion will anchor Calgary on the international map as a leading convention host, attracting larger conventions and meetings to our province.”

Designed by leading firms Stantec/Populous/S2 Architecture, the building's innovative design will dramatically

transform the Calgary skyline. Beyond being significantly larger than the existing BMO Centre offering double the rentable space, the new facility will reflect, inside and out, today's best practices in convention facility design.

The project is funded through equal contributions from three orders of government and provides opportunity for economic diversification and job creation in Calgary and the surrounding region.

When it opens in 2024, the BMO Centre will be the largest convention facility in western Canada, elevating Calgary into the top tier of the competitive international meetings and conventions market. 🍁



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Recognizing Excellence in the Remediation and
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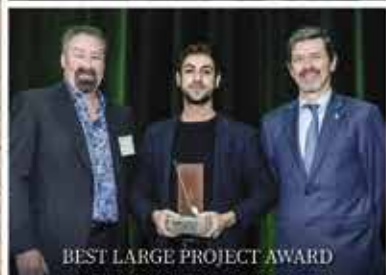
A LOOK BACK AT THE 2019 BROWNIE AWARDS



BROWNFIELDER OF THE YEAR



BEST OVERALL PROJECT AWARD



BEST LARGE PROJECT AWARD



BEST SMALL AWARD



REPROGRAM AWARD



REMEDiate AWARD



REINVEST AWARD



REBUILD AWARD



RENEW AWARD



REACH OUT AWARD

CONGRATULATIONS TO THE 2020 BROWNIE AWARD WINNERS



2020 BROWNFIELDER
OF THE YEAR, JOSEE
SAMSON.



2021 BROWNIE AWARD CATEGORIES

REFOCUS

Vision of Alternative Benefits
to Brownfield Remediation

REPROGRAM

Legislation, Policy & Program Initiatives

REMEDiate

Sustainable Remediation
& Technological Innovation

REINVEST

Financing, Risk Management
& Partnerships

REBUILD

Redevelopment at the local site scale

RENEW

Redevelopment at the community scale

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APPOINTED



Richard Lyall

The Residential Construction Council of Ontario (RESCON) announced that president **Richard Lyall** has been appointed to a steering committee of the Chicago-based Council on Tall Buildings and Urban Habitat (CTBUH) that will oversee a research project that will look at the potential benefits of using a hybrid of steel and timber in high-rise buildings.

The research project, officially called The Future Potential of Steel-Timber Composite Structures, will study the design, life-cycle cost, environmental, and market benefits of using steel-timber composite structures. The CTBUH received a grant from constructsteel, the steel construction market-development program of the World Steel Association, to conduct the research.

He joins four other steering committee members from the U.S. and Italy that will guide research activities and assist in the collection and interpretation of case study information. At the end of the two-year project, a guide for stakeholders will be published that will influence the future of the building industry.

"I am extremely honoured to be appointed to this special committee that will be doing ground-breaking research into how timber and steel can be used in the construction of tall buildings," said Lyall. "This is critically important work as the industry is looking at more sustainable construction methods which is driving interest in mass timber, not only because of its lower carbon footprint in production, but because of its ability to sequester carbon from the atmosphere as it grows."



Joanne Vanderheyden

At the Federation of Canadian Municipalities' (FCM) virtual 2021 Annual Conference and Trade Show, **Joanne Vanderheyden** was acclaimed as president.

The long-time Mayor of Strathroy-Caradoc, Ontario, succeeded Prince George, B.C.'s **Garth Frizzell**. Delegates also elected FCM's 75-seat and its three vice-presidents: (First vice-president) **Taneen Rudyk**—councillor, Town of Vegreville, Alta.; (Second vice-president) **Scott Pearce**—Mayor, Canton of Gore, Que. and (Third vice-president) **Geoff Stewart**—Deputy Mayor, Colchester County, Nova Scotia.

In a separate process, Halifax Mayor **Mike Savage** succeeded Edmonton Mayor **Don Iveson** as chair of FCM's Big-City Mayors' Caucus, and he will be supported by two vice chairs: Montreal Mayor Valerie Plante and Saskatoon Mayor Charlie Clark.

"President Frizzell has been an extraordinary leader for us in extraordinary times," said Vanderheyden. "Through these difficult months, FCM has secured vital progress for municipalities at the federal level—from funding to protect frontline services to rapid housing solutions to recovery-supporting investments in transit, rural broadband and infrastructure. That's a testament to Garth's leadership and it sets a high bar for FCM's work in this crucial year ahead."



David Lindsay

The Government of Ontario appointed **David Lindsay** as the new chair of Infrastructure Ontario. Lindsay has previously held the position of Deputy Minister at the Ministries of Energy and Infrastructure, Northern Development, Mines and Forestry, Natural Resources, and Tourism and Culture. He also served as the Principal Secretary and Chief of Staff to the Premier of Ontario from 1995 to 1997. Following this role, he was president and CEO of the Ontario Jobs and Investment Board from 1997 to 1999, and president and CEO of the Ontario SuperBuild Corporation. He is also the former president and CEO of the Council of Ontario Universities, the Forest Products Association of Canada and of Colleges Ontario.

"Mr. Lindsay's significant experience and leadership will be a great asset as we continuously strive to be a world-class agency helping the government create a more connected, modern and competitive Ontario," said **Michael Lindsay**, president and CEO of Infrastructure Ontario.



Darren Sokoloski



Sean T. Derry

AECOM announced that **Darren Sokoloski** has been named vice president of public-private partnership (P3) advisory services for its Canada business and that **Sean T. Derry** has joined the firm as vice president, transit and rail systems.

Sokoloski's career spans progressive roles at Acciona Infrastructure, Bilfinger Berger Project Investments, Macquarie Capital Markets Canada,

General Hydrogen and Ballard Power Systems. He has also built and managed his own infrastructure and renewable energy consultancy practice.

"I'm delighted to be joining a world class company like AECOM and to be working with a team of professionals who have established a compelling and highly valuable service offering for owners in the infrastructure sector," said Sokoloski.

Based in Ottawa, Derry will focus on systems engineering (16 competencies including systems integration) and systems assurance, guiding strategic thinking around rail systems development, planning and engineering on major projects and pursuits in Canada, the United States and globally. He will also be responsible for further development of AECOM's system engineering team in Canada and will serve as a leader and mentor to AECOM transit and rail systems staff.

Derry's 38-year career spans the transit, rail, design and construction industry in North and South America, the United Kingdom, Europe, Asia and the Middle East, delivering some of the world's most prominent and complex railway systems. His work experience includes leading the systems components on the \$1.9 billion Valley Line West light rail extension in Alberta, and the \$1.8 billion Broadway Subway Extension in British Columbia; serving as civil technical lead on the \$1 billion MetrôRio Rail Fleet Expansion Program in Brazil; serving as operational readiness director on the \$36 billion Qatar Railway New Build Program in Doha, Qatar; and managing delivery of several London Underground Limited projects.

"I'm thrilled to be working on new and exciting projects as a leader at AECOM," said Derry, "I am eager to bring my expertise designing tailored organization models to meet each project's unique needs and working with AECOM's future leaders to ensure continued success."



Max Mantha



Richard Whyte

EllisDon announced the appointments of **Max Mantha** to the role of senior vice president of Eastern Canada, and **Richard Whyte** to the role of vice president and Area Manager, Toronto Civil.

Mantha joined EllisDon's Civil Division in 2014 and was quickly appointed general manager of Looby Construction, an EllisDon subsidiary, where he assumed

the full financial, safety and operational responsibility of all Looby's business activities across Canada. After a year, he was appointed vice president and area manager for EllisDon Toronto Civil.

He will oversee all buildings and civil works in Eastern Canada and provide support to the regional offices in Toronto, London, Stratford, Ottawa and Halifax, as required.

"I am truly humbled to take on this exciting leadership opportunity with EllisDon," said Mantha. "I am so fortunate to have had the best teams, leaders, mentors, partners and family to support these exciting career developments. Together, we will continue to drive the success and entrepreneurial enthusiasm of this business forward."

Whyte joined EllisDon in 2014 as an estimator in the Toronto Civil group. The following year he was promoted to senior estimator having demonstrated great industry knowledge and an appetite to grow. In 2018 Whyte was promoted to chief estimator.

He will oversee all leadership and responsibilities as area manager of the

EllisDon Toronto Civil group.

"The opportunity to lead this team of dynamic and successful individuals is something I truly am excited about, and I can't wait to get started," said Whyte.



Fiona
Cochrane

Infrastructure BC announced the promotion of **Fiona Cochrane** as assistant vice-president. She will be focusing on the transportation and utilities sector.

Cochrane has a strong background in planning, structuring and procuring complex infrastructure projects with a focus in the transportation sector. Prior to joining Infrastructure BC as a project director in 2008, Cochrane was a management consultant, including in leadership roles with economics consulting practices at Grant Thornton and KPMG.



Sébastien
Tremblay

PCL Construction announced it will be expanding in Quebec with a permanent office in Montreal (Construction PCL) as well the appointment of **Sébastien Tremblay** as

vice president and district manager for Quebec.

"It's an honour to have the opportunity to build in Quebec. Whether it's a major project, historical project, or the smaller special projects we are working on," said **Todd Craigen**, president Eastern Canada. "We welcome Sébastien to our team—his experience and insights will help us continue to build amazing projects for clients and communities in Quebec."



Jesse Unke

Consulting firm COWI appointed **Jesse Unke** as vice president of operations in Canada. Unke brings with him more than 20 years of progressive experience and successful

leadership in the civil engineering and construction sectors, most recently with Vancouver, BC-based RAM Consulting.

"COWI has a great reputation in the industry," said Unke. "I look forward to working with our world-class specialists to grow the business and make COWI the first choice for clients in Canada and beyond." ♣

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A recent study underscores the importance of trees as natural cooling infrastructure and the availability of shaded green spaces.

COOL INFRASTRUCTURE TO COMBAT EXTREME HEAT

By Dr. Umberto Berardi

Recently, the Greenbelt Foundation published research from Ryerson University's BeTop Lab—a building science lab and research group looking at GHG emission reduction from the built environment. “Cooling Corridors: the Role of Green Infrastructure in Building Resilience to Extreme Heat,” quantified the positive impact that the Greenbelt's urban river valleys have on temperature.

The report explores the benefit of providing tree cover to mitigate the growing problem of extreme heat. By modelling different greening scenarios applied to two heat vulnerable neighbourhoods in the Region of Peel, it measured the cooling effect of tree canopy, demonstrating a considerable benefit to increasing tree coverage to reduce heat stress among urban residents. These results underscore the importance of trees as natural cooling infrastructure and the availability of shaded green spaces.

The recommendations in the Cooling Corridors report focused on increasing tree cover.

Generally, the major cooling effect of urban green infrastructure is due to the

fraction of the blocked solar radiation that reaches the urban surface, and the evapotranspiration of plants and soil of vegetation and tree coverage. Accordingly, many strategies pertaining to urban green cover could be implemented in the built environment to increase urban cooling performance. Increasing the vegetation cover reduces the absorbed solar radiation by urban surfaces; it also highly reduces the reflected solar radiation to the surrounding buildings. In addition, vertical facade greenery systems add to the insulation of buildings, reducing the internal energy consumption for cooling. They also limit the exposure of the building envelope to direct solar radiation, which allows better urban behaviour regarding solar reflections and absorption of urban surfaces. A similar effect can be attained by roof gardens and roof vegetation. Increasing urban water surfaces can also help in supporting the evaporative cooling effect of the local urban environment.

The investment in increasing and developing green infrastructure should include both the initial cost of the fixtures

and installations, as well as the long-term maintenance of the green cover. The economic value of each mitigation strategy should include the life cycle cost of the strategy, considering all maintenance, running and recycling costs. A successful financial management plan considers the district energy cost and health economic benefits to holistically indicate the impact of the greenery cover on the total neighbourhood life cycle cost.

Considering climatic behaviour that may impact the city's evolution is the key to building a sustainable community respecting and benefiting the environment. Overall, as we emerge from the pandemic, we have learnt the importance of clean and healthy environments and the need for cooling corridors has never been greater. 🍃



Dr. Umberto Berardi is a Professor in the Faculty of Engineering and Architectural Science at Ryerson University and Canada Research Chair in Building Science.



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